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THE MODERN TREATMENT OF

NERVOUS AND MENTAL DISEASES

BY EMINENT AMERICAN AND BRITISH AUTHORS

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FROM THE PREFACE

These volumes are designed to meet the needs which the rapid advances in knowledge of neurology and psychiatry have created. The nervous system is here regarded as a whole and as inclusive of the mind, and it is maintained that disturbances of any and all of its functions, mental as well as physical, are proper subjects for therapeutics. While, therefore, the various diseases have been considered in full detail, care has been taken to supply an omission conspicuous in previous treatises. Practically all such works have stopped short at the point where they should have begun. They have told us in large measure how to patch up broken machinery, but rarely have they ever suggested or given directions for avoiding the wrecks.

The present work lays emphasis upon the psychical side of life as being worth quite as much consideration as the physical. It sets forth doctrines of nervous and mental hygiene, reconstructive factors in social organization as applied to human ills, and endeavors to present a broad front to the pessimistic nihilism in therapeutics that has been too long current in these fields because the doctor's eyes have been too closely focussed on the individual examples and results of human accidents. Neurology and psychiatry offer the widest possible opportunities for preventive medicine as well as for therapeutic optimism.

The program here presented is essentially therapeutic. Planned as it has been on a broad scale, the more practical issues confronting the clinician have, nevertheless, been fully met.

(SEE ALSO THE PAGE OPPOSITE)

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THE

AMERICAN JOURNAL

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APRIL, 1913

ORIGINAL ARTICLES

A YEAR'S WORK IN HYSTERECTOMY.

By John B. Deaver, M.D., Sc.D., LL.D.,

PROFESSOR OF THE PRACTICE OF SURGERY IN THE UNIVERSITY OF PENNSYLVANIA; SURGEON-IN-CHIEF TO THE GERMAN HOSPITAL, PHILADELPHIA.

Experience to the physician, unlike the stern light of a ship which illuminates only that which it has passed, can more aptly be compared to the search light which may be turned into the darkness ahead lighting up both channel and obstructions.

The belief that a review of my cases of hysterectomy during the year 1911 might furnish some lessons for the future is the reason for this study. The various conditions for which the operation was done are shown in the following table:

	Cases.
Myoma	62
Myoma with sarcomatous degeneration	1
Adenomyoma	3
Carcinoma of uterus (cervix, 8; body, 6)	14
Carcinoma of Fallopian tube (primary)	1
Incomplete abortion	3
Cornual pregnancy	1
Stenosis of vagina	1
Prolapse of uterus	1
Metrorrhagia	11
Miscellaneous inflammatory conditions	11
	109

The operations were:

	Cases.
Complete hysterectomy	31
Vaginal hysterectomy	4
Supravaginal hysterectomy	74
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From this it is seen that myoma of the uterus furnishes the indication for the removal of this organ in rather more than half the cases. The great practical importance of this condition is emphasized by its frequency. The indications for operation in myoma of the uterus are a perennial source of strife. The radical view of the matter is that the diagnosis of the condition indicates operation. The conservative cannot be induced to recommend operation. For many years my position has been midway between these extremes. Postmortem figures compiled in large series of deaths from general causes show that about one-tenth of all women have one or more myomas of the uterus which vary in size from pea-like nodules to immense masses. In the large variety of cases these growths had nothing to do with death. It is evident therefore that there is no justification for advising operation in the cases of small symptomless fibroids, since the chances are remote that they will have any influence in shortening life. The case is entirely different when symptoms arise as a result of the growth of the tumor, of its unfavorable location, of the degeneration or accidents to which it is subject, or by reason of associated pelvic lesions.

The frequent association of other lesions in the pelvis with myoma of the uterus has impressed many observers. In the present series chronic endometritis was present in 40 cases, chronic salpingitis in 36 cases, acute salpingitis in 1, chronic metritis in 16, chronic oöphoritis in 16, and cystic disease of the ovary in 9. So frequent is it to find disease of one or more of the pelvic organs in the case of symptom-giving fibroids that the diagnosis of a troublesome fibroid is practically presumptive evidence of disease in the pelvis other than myoma of the uterus. The interesting question of the pathologic interdependence of these conditions and their relation to the clinical manifestations is too complex for general treatment or often for solution in the individual case. There is no evidence that fibroid disease of the uterus can directly cause inflammatory conditions of the adnexa, or *vice versa*. Neither is there any apparent connection between ovarian-cyst formation and the presence of fibroid tumors in the uterus.

It is fair to suppose, however, that the mechanical disturbances which follow the irregular enlargement of the uterus by myomatous disease can produce a state of lowered nutrition of the endometrium and myometrium or of the adnexæ which may permit more ready implantation of infection. Moreover, the close hormone relationship which we dimly know to exist between the various members of the genital system may be at the bottom of the association of lesions in many cases. But whether the coincidence be causal or accidental the argument for operation in these cases is strengthened by the probability of multiple lesions calling for correction.

The liability of myoma to degenerate into more serious conditions has been frequently urged as a reason for preventive removal. This argument has never appealed to me. Three hundred and forty-five cases of myoma were recently studied by Dr. Pfeiffer and myself, with special reference to degenerative changes, with the following result: Hyaline degeneration was found in 11 per cent.; cystic degeneration in 3.6 per cent.; hemorrhagic degeneration in 3.6 per cent.; calcareous degeneration in 2.4 per cent.; and sarcomatous degeneration in 1.2 per cent.

The benign forms of degeneration are not sufficiently serious to warrant preventive surgery. Sarcomatous transformation, on the other hand, is of very infrequent occurrence if the total incidence of fibroid tumors be taken into consideration.

It is one thing to say that in an operative series 1.2 per cent. of all fibroids showed sarcomatous changes and an entirely different thing to claim that the liability of myoma to degenerate into sarcoma is as 1.2 to 100, an error in logic into which many authors have fallen.

It is true, however, that myoma of the uterus predisposes to corporeal cancer of that organ. It is well known that ordinarily cancer of the cervix outnumbers cancer of the body of the uterus at least four to one. When myoma is present, however, fundal cancer is found more frequently than that of the cervix. It seems a fair assumption therefore, and one which is also suggested by the known tendency of chronic nutritional and irritative influences to excite malignant change, that a well-defined number of cases of cancer of the body of the uterus are precipitated by the presence of myoma. It is well to bear in mind therefore that the irregular uterine hemorrhage which is so frequent a result of fibroid disease may be a symptom of malignant change in the endometrium of the fundus. In this series I encountered one such case of myoma of the uterus associated with adenocarcinoma.

To my mind these risks of degenerations and of associated lesions make it desirable to remove all fibroids as soon as discovered, but it is not imperative or even advisable, even though in the best hands the risk of operation is slight. In this series there was one death due to sudden pulmonary embolism, which occurred during convalescence.

The uterus has been removed by some surgeons when no symptoms due to the tumor were present, save only a marked neurasthenia due to the patient's knowledge that she had a tumor. I would not accept this as an indication for operation save in exceptional instances.

The chief argument for removal of fibroids is presented by and not before the occurrence of symptoms. These again vary remarkably in severity and variety. Hemorrhage, chronic anemia,

malnutrition, and a weak and degenerated myocardium are not infrequent results. Pain, constant or intermittent, and of great severity, is not infrequently encountered. Pressure on the bladder, rectum, and uterus gives rise to complications. When a fibroid uterus gives trouble in any of these or other ways it should without hesitation be removed. There should be no waiting for the menopause in the vain hope of the disappearance of symptoms. This erroneous idea has been "scotched," but not entirely killed. Fibroids which give trouble before the menopause are apt to give more trouble afterward, while in many cases this trying time in a woman's life is indefinitely dragged out and made unendurably miserable. Often cases are brought into a condition of chronic invalidism through chasing this will-o'-the-wisp, and the inevitable operation is finally performed under conditions most unfavorable to the patient's recovery.

The most recent method of non-operative treatment that has been proposed for the treatment of fibroids of the uterus is the *x*-rays. We already know enough of the inefficiency of the *x*-rays in the treatment of deep-seated growths to discount the optimistic reports of some Röntgenologists. It is a certainty that this form of treatment cannot be truly curative, and we already have a surfeit of non-operative palliative methods in the treatment of surgical diseases which for the one case that is benefited causes ten to neglect timely recourse to the curative scalpel. I sincerely hope that we are not to experience in this new method a recurrence of the fallacies of the Apostoli treatment of a few years ago.

Adenoma was encountered three times during the past year. This condition, so beautifully described by Cullen, may be very difficult of diagnosis because the uterus is frequently but little enlarged and may be quite symmetrical. Free hemorrhage and grinding pain were the characteristics specially noted.

The frequency of carcinoma is illustrated by the fact that one hysterectomy in every eight was done for this disease. There is scarcely any kind of surgery that is more discouraging than this. The chief reason is the delay that occurs before these cases are brought to the surgeon. There were 8 cases of cervical cancer and 6 of cancer of the body of the uterus. In the cases of cervical cancer the average period elapsing between onset of symptoms and operation was exactly one year. In corporeal cancer the interval was greater, averaging two years and seven months. In 2 cases it was four years. This is certainly a poor showing considering the active propaganda for early diagnosis which has been in progress for several years. It is clear that these cases are brought to the surgeon not by the diagnosis, but by the development of such severe symptoms that the patient can no longer be satisfied by palliative and expectant treatment. Under conditions as they

are this disease is practically hopeless. Operation does but little more than relieve the mind of the patient and saddle the blame of the failure of treatment upon surgery. Practically the only cases of cancer of the uterus that I can claim to have cured are those that were operated upon before the disease had actually been demonstrated to be present. Until more reliable means of diagnosticating carcinoma in its incipiency have been devised it will be necessary for the profession to act upon shrewd tentative diagnosis if any progress is to be made in the cure of cancer of the uterus. The chief symptom upon which we must rely in the early diagnosis is irregular, excessive, or continued bleeding. This was mentioned as one of the initial symptoms in every one of the 14 cases. Pain was present in only 3 cases, and loss of weight in 8 cases, but these as well as other occasional symptoms were not early. We must continue to insist that uterine hemorrhage should always be construed as a danger signal, and just as a lump in the breast should be considered as malignant until its innocence is proved, so should a bloody discharge from the uterus be regarded as due to carcinoma until the reverse is established. This is especially true in the cancer age, but to a less degree it applies to earlier ages, since one of my cases was aged only twenty-six years and another thirty-six years.

As practical men we must realize that the difficulty in establishing this point of view comes from two sources: (1) The disinclination of many women to secure advice upon the subject until the disturbance is marked, and the disease, if cancerous, far advanced; (2) the failure of the physician to consider the serious aspect of uterine hemorrhage until secondary symptoms make their appearance. The remedy for both these faults lies in education, and I believe that the profession is chiefly at fault. If the family physician always insisted upon discovering the cause of irregular bleeding the laity would be quick to take alarm at a symptom held in such high esteem by the profession. It is the apathy of the profession that is responsible, just as it was and still is to a large extent in its attitude toward indigestion. Just as the leaven is working in connection with abdominal diseases so it must eventually be with pelvic disturbances.

Acting in accordance with this belief I have during this year removed 13 uteri for irregular or severe hemorrhage. Not all these cases were suspected of being carcinomatous, but in several the probability was strongly considered; 11 cases showed chronic endometritis, 5 being of the hyperplastic variety and 2 showed polyp formation. In 1 the hyperplastic process was so marked as to justify the term adenoma of the endometrium. In such a case the development of cancer is to be greatly feared. In 1 case the endometrium was hyperplastic and irregular, and while the

pathologist could discover no frank signs of malignancy, he commented upon its close relation to cancer. These cases all recovered, and I feel that great good has been done by the operations, which is more than I can say of the operations in the cases diagnosticated cancer, for of the ultimate results in these I am not sanguine. It is necessary to state that care must be exercised in coming to the conclusion to remove the uterus on symptoms alone, since uterine hemorrhage can occur in such a variety of less serious conditions that one may be led to do much useless surgery. I must own to having removed two uteri that were afterward discovered to show incomplete abortions. The third case of incomplete abortion upon which I operated had interstitial uterine abscesses and the operation was performed with knowledge of the condition. I was chagrined at removing a uterus for retained secundines, but with similiar histories I have no doubt I would do so again, and from the long point of view it is justified, since it is better for a patient to lose her uterus unnecessarily than her life.

It is sometimes wise to remove the uterus in the course of opertions for diseases that do not ordinarily indicate hysterectomy. In a case of cornual pregnancy the uterus was so eroded as to render repair uncertain and more dangerous than removal. Ordinarily adhesions and pelvic inflammatory disease give rise to conditions in the pelvis that can be remedied most expeditiously and safely by removing the uterus along with the other offending tissues. Intraligmentary cyst not infrequently defies complete removal without bringing the uterus along with it. In all such cases I prefer to leave the uterus if it can be done, as its preservation is less likely to cause weakness in the pelvic floor. Still when operative reasons indicate its removal we can now have the feeling that hysterectomy has reached a high degree of perfection and safety. The mortality in the series here reported was one-tenth of 1 per cent.

DIABETIC STANDARDS.

By Elliott P. Joslin, M.D.,

ASSISTANT PROFESSOR OF THE THEORY AND PRACTICE OF PHYSIC IN THE HARVARD MEDICAL SCHOOL, BOSTON, MASSACHUSETTS.

Whenever I see the enthusiastic report of a new drug or remedy employed in the treatment of diabetes, certain cases of my own and other men come to my mind. First of all I critically examine the data relating to the new methods, and then compare the results with the cases which I have had under my eyes for years.

Gradually these cases have grown to be my *diabetic standards*. I hope to raise these standards as time goes on, and undoubtedly there are other physicians who can supply better standards; but if mine suffice to show what can be accomplished without drugs, they will have served some purpose. But each physician should have his own standard diabetic cases. This will enable him to compare the results of his past and present methods of treatment, and show him when to relinquish his own methods in favor of those of other men. Such comparisons unconsciously lead to better records of cases, and stimulate to better work.[1]

The reported duration of treatment with new remedies is usually only for a period of weeks, seldom months, almost never years; for this reason I have selected cases of long duration, extending respectively over fifteen, twenty, thirteen, seven, twelve, three years and eleven months, nineteen, and six years. The shortest period during which one of these patients has been under my own observation has been five months, the longest period thirteen years. The change in the character of the urine following new methods of treatment is too often reported by a change in per cent. I have attempted to give the change in the total quantity of the sugar during the course of the case. The total quantity of carbohydrates in the diet of cases treated by drugs is rarely, if ever, accurately given. Unfortunately, I can by no means always give an accurate statement of the quantity of carbohydrates in the diet of my cases, but in many instances an accurate or nearly accurate figure will be found recorded. My standard cases are as follows:

Case I.—Mild diabetes (glycosuria) in a man, with onset when aged thirty-three years, who became sugar-free, and remains so after fifteen years, upon a diet containing 125 grams carbohydrate.

Case II.—Moderately severe diabetes in a man, with onset when aged fifty years, who, when aged sixty-six years became sugar-free, and succumbed to arteriosclerosis and Bright's disease at seventy, without return of sugar in the urine.

Case III.—Moderate diabetes in a woman with onset when she was aged sixty years, who after thirteen years upon a restricted diet maintains unusual physical and mental vigor.

Case IV.—Severe diabetes in a financier with onset when he was aged forty years, undiagnosticated for four months, but later treated with extreme care and complete coöperation on the part of the patient. Duration eight and one-half years.

Case V.—In contrast—severe diabetes with *diabetic heredity* in a bank clerk, with onset when aged thirty-seven years. He gave up the opium treatment with despair some months after

[1] As diabetic records are of necessity voluminous it will be found helpful to file them separately apart from one's general records.

onset, and under a closely restricted diet for eighteen months, and later upon a moderately restricted diet, lived twelve and one-half years.

CASE VI.—Severe diabetes in a boy, aged fourteen years, who lived three years and eleven months.

CASE VII.—In contrast—severe diabetes with *diabetic heredity* in a girl, aged seventeen years, who withstood the disease twenty-one years.

CASE VIII.—Moderate diabetes occurring in a woman when aged forty-seven years (perhaps earlier), who successfully withstood the removal of an immense fibroid tumor, and is comfortable at fifty-three.

The treatment of these patients had as its main object the removal of sugar from the urine by dietetic measures, provided weight and strength could be maintained. The diet usually prescribed was based upon the following chart, which has been found adequate. Usually a diet containing 150 to 100 grams carbohydrate was given at the start, and gradually the carbohydrates were lowered until the sugar disappeared from the urine. Vegetable days were freely employed and occasionally oatmeal days.

STRICT DIET.—Meat, Poultry, Game, Fish, Clear Soups, Gelatin, Eggs, Butter, Olive Oil, Coffee, and Tea—and for variety, Tongue, Sweet Breads, Tripe, Kidneys, Pigs' Feet, Brains, Bone-marrow, Anchovies, Caviar, Lobster, Crabs, Sardines, Shrimps, Bologna Sausage, Smoked or Pickled Meat, or Fish.

PERCENTAGE OF CARBOHYDRATES IN

5 per cent. or less.		10 per cent. ±.	15 per cent. ±.	20 per cent. ±.
Lettuce	Cauliflower	Onions	Green peas	Potatoes
Spinach	Tomatoes	Squash	Artichokes	Shell beans
Sauerkraut	Rhubarb	Turnip	Parsnips	Baked beans
String beans	Egg plant	Carrots	Canned lima beans	Green corn
Celery	Leeks	Okra	Apples	Boiled rice
Asparagus	Beet greens	Beets	Pears	Boiled macaroni
Cucumbers	Watercress	Mushrooms	Apricots	
Brussels sprouts			Cherries	Plums
Sorrel	Butternuts	Lemons	Currants	Bananas
Endive		Oranges	Raspberries	
Unsweetened and unspiced pickle		Cranberries	Huckleberries	Almonds
Ripe olives	Clams	Strawberries		
Grape fruit	Scallops	Blackberries	Pecans	
	Fish roe	Gooseberries	Filberts	
		Peaches	Walnuts	
6 per cent or less.		Pineapple	Pistachios	
Cabbage	Oysters	Watermelon	Beechnuts	
Radishes	Liver	Musk melon		
Pumpkin				
Kohl-rabi		Brazil nuts		

Food.	Protein. Gm.	Fat. Gm.	Carbohydrates. Gm.	Calories.
100 grams.				Approximate.
Beef, mutton, fowl, fish (uncooked)	20	5–10	..	125–170
Ham	20	25	..	300
Bacon	12	50	..	500
One egg—about 50 grams, without shell	6.5	5	..	75
Milk	3	4	5	70
Cream, good	3	20	3	200
Cream, very thick	3	40	3	400
Butter	1	85	..	800
Cheese	25	33	2	400
Bread	9	1	60	275
Wheat flour	12	..	75	350
Rice	8	..	80	350
Oatmeal	16	7	66	375
Potato	2	..	20	90

Vegetables lose carbohydrates in the cooking, especially if the water is changed twice. It is approximately correct to consider a mixture of those in the 5 per cent. and 6 per cent. groups as containing 3 per cent. carbohydrates or 1 gram to the ounce. Meat loses 25 per cent. water in the cooking.

Starch is better assimilated than sugar in glycosuric patients.

Potatoes and eggs of similar size weigh about the same.

One egg and 25 grams cooked (1 ounce uncooked) meat contain equal amounts of albumin, or approximately 1 gram nitrogen; 6.25 grams albumin contain 1 gram nitrogen.

One gill (3 tablespoonfuls) oatmeal weighs 36 grams (containing 1 gram nitrogen and 24 grams carbohydrate) and this if cooked amounts to (4 tablespoonfuls) 250 grams.

Approximately 80 grams glucose may be formed from 100 grams albumin.

One gram albumin contains 4 calories.

One gram carbohydrate contains 4 calories.

One gram fat contains 9 calories.

One gram alcohol contains 7 calories.

One kilogram = 2.2 pounds; 30 grams (gram) or cubic centimeters (c.c.) = 1 ounce.

A patient "at rest" requires 30 calories per kilogram body weight.

Consult the Chemical Composition of American Food Materials, Bulletin No. 28, United States Department of Agriculture, Office of Experiment Stations, Washington, D. C.

The preliminary diet often was as follows:

	Nitrogen, grams.	Total carbohydrates. Grams.
Strict diet, meat limited to 300 grams, 3 eggs	13.0	
Vegetables in the 5, 6, 10 per cent. groups	....	10
Cream, 250 c.c. (½ pint)	1.5	5
Three small oranges or grape fruit	....	30
Oatmeal, 36 grams (1 gill—dry)	1.0	25
Bread made with water and without sugar, 100 grams	1.5	55
Milk, 500 c.c.	3.0	25
	20.0	150

Changes in the diet were made by the omission of milk, bread, and finally by the simultaneous reduction of oatmeal and fruit.

Even before cream was thus reached, however, the quantity of meat would be reduced to about 200 grams and fat increased.

When acidosis was present alkali was administered in the form of sodium bicarbonate or sodium citrate. Twelve to twenty-four grams daily represented the usual dose.

Case I.—Mild Diabetes. Case No. 30. Male, born in 1864. Sugar was found in the urine upon a single occasion in 1897. There was no family history of diabetes. Measles, whooping cough, diphtheria, and typhoid fever were the only illnesses except attacks of acute duodenal indigestion at several different times and even in childhood. Indigestion persisted until 1902, when sugar was found again in the urine in one of five portions, to the amount of 0.3 per cent. Following the restriction of carbohydrates to 110 grams, sugar disappeared, save in the specimen voided after lunch, in which 0.2 per cent. was present. During 1903, 1904, and 1905, despite an increase of carbohydrates in the diet up to 125 grams, or slightly more, sugar remained absent. Upon April 14, 1906, the examination of the urine voided after lunch showed 0.5 per cent. of sugar, and that after dinner 1.1 per cent. of sugar. During the following month all specimens examined contained sugar at one or more times of the day. Beginning with 1907, sugar has remained absent from the urine in all specimens examined except in a single specimen after lunch in 1908, and again under similar conditions in 1909. The diet has increased to approximately 140 grams carbohydrates. There has been no reappearance of indigestion. Bodily weight and mental vigor have been maintained.

Case II.—Moderate Diabetes. Case No. 354. Was at the head of a large insurance office. He was born in 1841, and gave no history of diabetes in the family. At the age of thirty-nine years disease of the heart was discovered. Except for alcohol in considerable quantities, and tobacco in excessive quantity, the previous history was unimportant. In 1891, at the age of fifty years, sugar was discovered in the urine. The patient claimed to have followed no treatment for the diabetes, but as a matter of fact, he was a most intelligent man, and inquiry has shown his diet to have been most carefully selected, conforming in general to that prescribed today for diabetic patients. From the very start he omitted sugar, and markedly increased the quantity of fat. The diet, however, was at no time rigid, being chiefly characterized by the preponderance of fatty foods and the avoidance of actually sweet articles. In 1907, at the age of sixty-six years, he was able to give up dieting altogether, for even when he took sugar it failed to appear in the urine, though incidentally albumin began to occur, and in 1910 was present in large quantities. A year later, at the age of seventy years, he died of arteriosclerosis, with accompanying nephritis, but without sugar having appeared in the urine in the interval. The last examination of the urine was as follows:

August 22, 1911. Specific gravity, 1015; reaction acid; albumin, 0.15 per cent. by Esbach; sugar none. Hyaline and granular casts and a moderate amount of pus.

CASE III.—Moderate Diabetes. Case No. 8. Showed the first symptom of diabetes in the spring of 1899 at the age of sixty years, and 5 per cent. of sugar was found in June. She had gradually lost during the preceding fifteen years 13.5 per cent. of her weight (185 to 165 pounds). Under rigid diet the urine promptly became sugar-free, and save for very transitory intervals remained so for nine years, until 1908. During 1908 and until the autumn of 1909 it returned, but except at one analysis was less than 1 per cent. In October, 1909, the sugar amounted to 4.6 per cent., and a carbuncle appeared. With prompt surgical care, vaccines, and restriction of carbohydrates, and the utilization of the oatmeal diet the sugar disappeared and the carbuncle healed promptly. But the urine did not remain permanently sugar-free, although only about 30 grams of sugar were excreted daily. In the spring of 1911 the sugar again rose at the time of an attack of lobar pneumonia, but as recovery took place and with restricted diet, the sugar disappeared. Evidently the patient could be freed from sugar, but upon a diet containing only about 30 grams of carbohydrate. This was too narrow for the patient after thirteen years of dieting, so that it was practically impossible to keep the urine free from sugar continually. Residence in a hospital for a few days in September, 1912, in order to have several teeth removed, lowered the sugar to 0.8 per cent.

Except for the brief periods of illness due to the carbuncle and pneumonia the patient remained well during all these years, and was unusually strong and vigorous for a woman of seventy-three years. I have had no patient follow directions more conscientiously. It is my present plan to prescribe a restricted diet one day in the week and to gradually increase the carbohydrate on the others up to 70 grams daily, repeating the cycle weekly.

Add to articles included in strict diet.	Mondays.	Tuesdays.	Wednesdays.	Thursdays, Fridays, Saturdays, and Sundays.
	Carbohydrates Gm.	Carbohydrates Gm.	Carbohydrates Gm.	Carbohydrates Gm.
Vegetables, 5, 6, 10 per cent. groups	10	10	10	10
Cream (250 c.c.)	5	5	5	5
Grape fruit (one-half)	5	5	5	5
Orange	..	½ = 5	1 = 10	10
Oatmeal, 2 tablespoonfuls	..	12	12	12
Potato, 60 grams	..	..	12	12
Bread, 30 grams	..	..	..	18
Total	20	37	54	72

Sugar-free milk,[2] Akoll Biscuits, Alpha Biscuits, and gems made from Barker's Gluten Flour[3] are allowed on all days, and an ounce of whisky, more or less, is taken.

CHART TO ILLUSTRATE CASE III.

Moderate Diabetes. Onset, 1899. Alive, 1912.

Date.	Volume, c.c.	Diacetic acid.	Sugar.		Carbohydrate intake, grams.	Weight in pounds.
			Per cent.	Total grams.		
June 28, 1899	1220	0	5.0	61	...	161
June 30, 1899	1720	0	3.8	65	0	
July 1, 1899	1250	0	1.0	13	10	
July 2, 1899	....	0	0	0	10	
Jan. 1, 1900	1200	..	0.3	4	45	174
Sept. 21, 1900	1500	..	0	0		
March 12, 1901	1415	0	1.2	17	35	176
June 1, 1901	1420	0	1.0	14		
June 5, 1903	750	..	0	0	70	150[4]
May 5, 1904	1000	..	0	0	100	
May 29, 1905	1000	..	0	0	130	
Aug. 14, 1906	1200	0	0	0	...	152
May 24, 1907	700	+	0	0		
May 23, 1908	740	0	0.4	3		
Nov. 10, 1908	960	0	0.8	8		
Jan. 9, 1909	1150	0	0.8	9		
Oct. 11, 1909	1290	0	3.2	41		Carbuncle
Oct. 12, 1909	860	++	2.0	19	54	
Oct. 13, 1909	700	+++	0.7	3	66	
Oct. 14, 1909	700	+++	0.2	1		
Oct. 15, 1909	760	++	0.4	3	87	
Oct. 16, 1909	910	+	0.2	4	89	
Oct. 17, 1909	800	+	0	0	76	
Oct. 18, 1909	780	0	0.2	2	78	
Oct. 21, 1909	1060	0	0	0	70	146
May 14, 1910	1400	0	1.2	17	70	155
March 13, 1911	1640	0	1.8	30		
May 14–15, 1911	925	0	3.4	31	...	Pneumonia
May 16–17, 1911	1250	0	4.0	50	65	
May 17–18, 1911	1240	0	3.4	42	65	
May 18–19, 1911	1075	0	3.0	32	60	
May 19–20, 1911	1550	0	3.8	59	60	
May 21–22, 1911	900	0	2.8	25	85	
May 22–23, 1911	600	0	2.8	17	70	
May 24–25, 1911	870	+	1.2	10	30	
May 26–27, 1911	1150	0	0.8	9		
May 28–29, 1911	890	0	0	0		
Nov. 17, 1911	1720	0	2.2	38		
Jan. 20, 1912	1520	0	2.6	40	70	
April 29, 1912	1540	0	0.6	9		
Sept. 9, 1912	2000	0	2.8	56	70	
Sept. 11, 1912	960	0	1.0	10	30	143

[2] Prepared by D. Whiting & Sons, Boston, Mass.
[3] Obtainable at 433 Broadway, Somerville, Mass.
[4] Weight, September 8.

Chart to Illustrate Case IV.

Severe Diabetes Onset, 1903. Died, 1912.

Date.	Volume, c.c.	Specific gravity.	Diacetic acid.	β-oxybutyric acid. Grams.	Nitrogen grams.	Ammonia.		Sugar by		Carbohydrate intake. Grams.	Alcohol c.c.	Carbohydrate balance. Grams.	$NaHCO_3$ Grams.	Weight. Pounds.
						Total grams.	Per cent. of nitrogen.	Fehling. Per cent.	Rotation. Grams.					
March 21, 1904	..	1041	..	..	..	..	..	7.8						
March 30, 1904	..	1022	..	..	..	..	..	1.1						
April 15, 1904	..	1025	..	..	..	..	..	0.0						
March 13, 1905	..	..	..	..	..	..	..	3.5						
April 13–14, 1908	2000	1033	Trace	..	25.6	1.1	3.8	.. Grams.	38	15	..	−25		
June 19–20, 1910	2100	1029	++	..	..	..	..	91	..	..	0			
July 6– 7, 1910	3340	1028	+++	28.9	22.5	5.7	20.8	107	73	20	0	−85	24	128
Sept. 14–15, 1910	2560	1029	++++	32.8	16.8	4.1	20.1	63	41	20	8	−45	20	126
Dec. 7– 8, 910	3500	1025	++++	42.6	15.8	5.1	26.5	77	56	20	10	−55	20	123
March 16–17, 1911	4380	1027	+++	52.7	19.5	7.1	29.9	180	158	125	30	−55	20	
Dec. 25–26, 1911	4700	1027	+++	54.8	14.5	6.3	35.7	188	160	135	45	−55	23	111
March 17–18, 1912	2940	1020	0	6.1	9.1	0.	8.1	82	82	150	45	+70	15	
March 26–27, 1912	2400	1032	0	2.6	9.9	.3	10.8	134	115	150	45	+15	5	76

CASE IV.—Severe Diabetes. A gentleman (Case No. 344) born March, 1863, married, financier, developed symptoms of diabetes in November, 1903, but the diagnosis was not made until March 21, 1904. He came under my observation June 27, 1910, and died of pulmonary tuberculosis in March, 1912.

There was no history of diabetes in the family. Seven uncles died of pulmonary tuberculosis.

He had suffered from measles, mumps, whooping cough, typhoid fever, scarlet fever, jaundice at approximately fifteen years of age, and malaria upon two occasions.

The record of the case is given in full because no patient has come under my observation who more carefully carried out modern dietetic treatment and also because of the extreme acidosis which disappeared with the onset of tuberculosis. In November, 1903, the patient was "run down," and in January, 1904, polydipsia appeared and he was a trifle irritable. The urine of March 21, 1904, had a specific gravity 1041, with a sugar content of 7.8 per cent. Under dietetic treatment sugar disappeared from the urine by April 15, 1904, and did not return until March 13, 1905, when the diet was somewhat relaxed. Later it again disappeared, not recurring until October 24, 1905. It was absent throughout 1906, and present at only two of fifteen analyses during 1907. On January 24, 1908, 0.3 per cent. of sugar was present; in April of the same year Professor von Noorden found difficulty in making the urine sugar-free, despite vegetable days and oatmeal days, and from this time on the sugar was invariably present. Along with the gradual increase in acidosis, which was first noted in 1908, the diet was gradually relaxed, and apparently each time with benefit. During the latter part of December, 1911, tuberculosis appeared and the weight fell rapidly. With the appearance of the tuberculosis there was a gradual increase in the tolerance for carbohydrates and a decrease in the acidosis. Similar occurrences have been recorded by various writers.

Physical Examination: Greatest weight, 147 pounds, without clothing; June 27, 1910, 133 pounds, without clothing. Height, 6 feet. Pupils, equal and reacted to light. Teeth in excellent condition, undoubtedly due in part to cleansing by dentist every six weeks. Lungs normal. Heart, apex in mammillary line, systolic murmur at base and apex. Blood pressure, 126. Pulse rate, 96. Right kidney large and palpable throughout. Liver, spleen, and left kidney not palpable.

The reaction of the urine was acid throughout the period of our observation, and the acidosis was extreme from June, 1910, until the last few months of life. In no other case coming under my observation has the quantity of β-oxybutyric acid been greater than with this patient. It increased to over 50 grams in March, April, August, September, November, and December, 1911, and on Christmas Day was 54.8 grams. Although the amount of

nitrogen in the diet was kept at a moderate level, the ammonia was high from the first, reaching 8 grams in February, 1911, notwithstanding 20 grams of sodium bicarbonate were being taken daily. The quantity of sugar steadily rose from approximately 50 grams in June, 1910, up to 200 grams in March, 1911, but subsequently somewhat decreased, falling far below this in the spring of 1912, coincident with the presence of tuberculosis. A minus carbohydrate balance was present from June, 1910, until the last two months of life. The body weight slowly fell from 133 pounds on June 29, 1910, to 76 pounds on March 23, 1912.

CASE V.—Severe diabetes but with *hereditary taint*. This patient (Case No. 10), like the preceding and indeed like most cases of diabetes was of moderate severity at the onset. He was a bank clerk who suddenly developed diabetes at the age of thirty-seven years, March, 1898, following unusual responsibility. A brother had already died of diabetes after a few months illness at the age of fifteen years. A sister died of pulmonary tuberculosis. In October, 1899, he came under my observation discouraged and exhausted with the opium treatment which had been prescribed, having lost 45 pounds, 200 pounds to 155 pounds, which was 22.5 per cent. of his greatest weight, and with the symptoms which accompany the excretion of 233 grams of sugar (8.1 per cent.), in twenty-four hours. Under rigid dietetic treatment he became sugar-free for a few days at a time during the ensuing year, and gained 16 pounds. In November, 1901, acidosis appeared and persisted at least up to within a few months of his death, twelve and one-half years after the onset, in October, 1910. During nearly all this period he filled his position. He suffered from suppuration about the teeth, and at one time had an ulcer on the foot, but at length succumbed to pulmonary tuberculosis.

CHART TO ILLUSTRATE CASE V.

Severe Hereditary Diabetes. Onset, 1898. Died, 1910.

Date.	Volume. c.c.	Diacetic acid.	Ammonia Total. Grams.	Sugar. Per cent.	Sugar. Grams.	Carbohydrate intake. Grams.	Weight. Pounds.
March 7, 1899	1900	..	..	0.9	17		
Oct. 10, 1899	2880	0	..	8.1	233	185	
Oct. 14, 1899	1455	+	..	3.4	49	40	157
Oct. 24, 1899	2000	0	..	0	0	..	161
Nov. 10, 1899	2000	0	..	3.7	74	..	163
Nov. 14, 1899	1870	0	..	0	0	..	163
Jan. 2, 1900	1500	0	..	4.6	69	..	166
Jan. 18, 1900	1500	0	..	0	0		
May 21, 1900	1500	0	..	0	0	0	
Nov. 11, 1901	2750	+	..	4.0	110	..	161
March 9, 1908	5000	++	4.0	5.6	280	..	149[1]

[1] Weight, February 28.

CASE VI.—Severe Diabetes in Childhood. Case No. 74. A boy, aged fourteen years, developed the symptoms of diabetes in January, 1904, and a month later sugar was found in the urine. There was no diabetic heredity. In April, 1904, he came under my observation, and I saw him off and on with Dr. F. H. Thompson, of Fitchburg, who watched over the case with unusual care until the death of the patient in coma in December, 1907. The disease ran a course free from complications. The patient was sugar-free from May to December, 1904. Acidosis was present throughout. No case has come under my personal observation who developed diabetes so young and yet lived so long.

CHART TO ILLUSTRATE CASE VI.

Severe Diabetes. Onset, January, 1904. Died, December, 1907.

Date.	Volume c.c.	Acetone.	Diacetic acid.	Ammonia, total. Grams.	Sugar.		Carbohydrate intake grams.	Weight pounds.
					Per cent.	Grams.		
Apri 20, 1904	1080	+	0	..	2.5	27	..	92
May 22, 1904	1290	+++	+	..	1.2	15		
Dec. 21, 1904	1310	0	0	..	0.2	3		
Feb. 9, 1905	1470	+++	+++	..	1.1	16	..	101
Oct. 24, 1905	1860	+++	+++	..	2.9	54	..	105[6]
July 15, 1906	....	+	++	..	1.9			
Nov. 27, 1906	....	+++	+++	..	4.1	..	..	104
Jan. 10, 1907	1920	..	++++	2.9	3.4	65	..	106
April 30, 1907	2640	..	++++	4.8	3.2	03	..	104
Nov 13, 1907	2520	..	++++	3.3	3.9	98	66	

CASE VII. — Severe diabetes in youth with *diabetic heredity.* In contrast to the severe diabetes in the boy just cited, diabetic heredity was marked in Case 310, who developed diabetes in 1889 when aged seventeen years. She did not come under my observation until twenty-one years later. Her father died of kidney trouble at seventy-seven years, mother of diabetes at forty-seven years, one brother of diabetes at twenty-one years, one sister when aged about seventeen years had sugar in the urine for a period of eight months. Five brothers and sisters died in infancy, of whom one had diphtheria, and one was said to have been a blue baby. A brother and sister are well.

The first symptom of diabetes was fearful thirst while the patient was at school. The urine was voided in great quantities. Three years later sugar was demonstrated in the urine, but despite its presence the patient continued to travel and work enthusiastically. Having gone through a nurses' training school, she became a nurse, and did much hard work. The greatest volume of urine recorded

[6] October 6.

was 5400 c.c., and the specific gravity is said to have reached 1060. On March 5, 1904, the specific gravity was 1046. When examined in 1910 the patient exhibited very little thirst, no abnormal appetite. Exhaustion, insomnia, headache, poor eyesight, and pains throughout the body were the chief complaints. The hands were cracked and felt like sandpaper. There were callous spots on the feet, yet the patient said she felt "just as well as I can be." Her greatest weight was 134 pounds, and this was in 1909, but in 1910 the weight had fallen to 116 pounds. Despite the patient's contention that she was in good condition, it was obvious that she was really quite ill. The following chart shows the condition of the urine:

CHART TO ILLUSTRATE CASE VII.

Severe Hereditary Diabetes. Onset, 1889. Died, 1910.

Date.	Volume, c.c.	Specific gravity.	Diacetic acid.	β-oxybutyric acid.	Nitrogen, grams.	Ammonia, total grams.	Sugar.		Carbohydrate in diet, grams.	Carbohydrate balance, gms.	Weight of patient, lbs.
							Fehling, gms.	Rotation, gms.			
Jan. 20–21, 1910	3620	1036	0	...	....	...	...	260			
Jan. 24–25, 1910	2880	1032	0	...	15.0	2.0	...	161	185	+25	109
Feb. 1– 2, 1910	2730	1025	0	...	11.6	...	96	87	130	+45	114
Feb. 7– 8, 1910	2660	1026	0	...	11.4	...	113	95	165	+70	115
Feb. 9–10, 1910	2185	1023	0	...	10.6	2.9	66	57	95	+40	116
Feb. 12–13, 1910	1725	1022	Slight +	8.3	9.1	...	45	38	45	+5	117

From the urinary chart it will be seen that the patient upon taking a large quantity of carbohydrate apparently assimilated a portion, but when carbohydrates were restricted acidosis appeared. The acidosis became manifest as soon as the carbohydrates in the diet were lowered. It was for this reason unquestionably that the patient succumbed to diabetic coma soon after starting on a sea voyage. Soon after sailing she became sea-sick, and within three days diabetic coma developed, and death ensued. The explanation would appear to be that while sea-sick she was unable to take any food. As a result of no new carbohydrates being furnished to the body, the small store of carbohydrates existing, which of course was extremely small on account of the diabetes, was soon exhausted, and in the absence of the oxidation of carbohydrates acidosis became more severe, and death resulted.

CASE VIII.—Surgery in a case of moderate diabetes. Case No. 120, a married woman without diabetic heredity, was proved to have diabetes at the age of forty-seven years, in April, 1906. The urine then contained 7.2 per cent. of sugar. The date of onset of the diabetes was not accurately known, though the pruritus which had led her to a physician was first observed two months before. The patient said she had always been thirsty, for at least

ten years had passed urine frequently, and for five years had taken a pitcher of water to her bedside each night. However, seven years before an examination of the urine by a reliable physician disclosed nothing wrong. In 1904, she became aware of a fibroid. In 1906, she had lost 16.5 per cent. of her weight (230 pounds to 192 pounds). Under moderate dietetic restrictions the urine became sugar-free, but never more than for a few days, presumably because the diet was only followed with laxity. Early in January, 1908, the fibroid became so troublesome that an operation was urgent. The patient gradually was made sugar-free, and a fibroid tumor which then reached above the navel was removed by Dr. F. B. Lund. Convalescence was uneventful, and the patient remains in excellent condition. Sugar has returned, however, unlike the fortunate case of Dr. Joseph L. Miller,[7] in which it permanently disappeared following the operation.

CHART TO ILLUSTRATE CASE VIII.

Surgery in Moderate Diabetes. Onset, 1906. Alive, 1912.

Date.	Volume, c.c.	Diacetic acid.	Sugar. Per cent.	Sugar. Total grams.	Weight of patient. Pounds.	
April 9, 1906	2500	0	7.2	180		
April 12, 1906	1200	Slight trace	4.7	56	198	
April 19, 1906	1125	Slight +	0.5	6	200	
May 1, 1906	1160	Slight +	0	0	199	
June 2, 1906	1160	0	0	0	198	
Feb. 17, 1907	820	Slight +	2.2	18	200	
May 17, 1907	850	++	0	0		
Feb. 22, 1908	....	++	0.6	..	..	Removal of uterine fibroid.
Feb. 26, 1908	....	0	0	0		
June 6, 1908	1260	0	0	0		
June 18, 1908	1040	0	0	0		
June 21, 1908	....	++	1.2			
July 28, 1908	1340	..	0	0	185	
Feb. 22, 1909	1210	0	0.5	6	185	
July 11, 1911	850	0	3.8	32		

[7] Jour. Amer. Med. Assoc., 1912, 933 (discussion).

HIGH ARTERIAL PRESSURE: HIGH PRESSURE HYPERTROPHY OF THE HEART.[1]

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For a long time clinicians and pathologists in studying diseases of the circulation centred their attention almost exclusively on the heart. And even today we speak of heart failure, although we know that taken by itself such a thing is of extreme rarity. In the maintenance and control of the circulation the heart does not stand alone; it shares the responsibility with the bloodvessels, which participate actively in propelling the blood and in maintaining the blood pressure. The specific subject I wish to take out of this extensive and important field and discuss is high arterial pressure. I use this term instead of arteriosclerosis partly because the two are not synonymous, though often so used, and partly because the latter, arteriosclerosis, conveys the idea of an anatomic lesion, a terminal event best studied after death; while the former indicates at once a vital functional alteration with a direct bearing upon symptoms.

What do we mean by high arterial pressure? High arterial pressure is a relative term. Sex, age, and other factors must be taken into consideration. Up to a few years ago clinicians trusted to their fingers and eyes, but now we have fairly accurate and convenient devices by which we can determine quantitatively the amount of arterial pressure. The signal advantages of instrumental determination must be at once apparent. They are greater accuracy, standards of comparison, and ability to control treatment by recorded observations. The sphygmomanometer is to blood pressure what the hemocytometer and hemoglobinometer are to blood. Before we had them we knew of anemia, but had no definite standards and no basis for records. It is beyond the province of this paper to discuss the various instruments on the market. None is perfect; all are subject to the inevitable influence of the personal equation; but variations due to error are slight.

To know whether the blood pressure is high or not it is necessary to know the normal standards. These vary somewhat with different observers. The best records are probably those that have been obtained by careful insurance examiners, as such examiners deal more frequently than we do with healthy persons. Dr. Woley, of Chicago, in a study of 1000 healthy individuals, found the average to be as follows:

15 to 30 years	Blood pressure, 115 mm.
30 to 40 years	Blood pressure, 127 mm.
40 to 50 years	Blood pressure, 130 mm.

[1] An address delivered by invitation before the Wayne County Medical Society, Detroit, Michigan, May 20, 1912.

For women of the same ages the blood pressure is from 8 to 10 mm. lower. Not only age and sex, but also mental state, posture, and many other factors have an influence. Under excitement the blood pressure may rise 20 to 30 or even more millimeters. Due allowance must always be made for these variable factors.

Clinicians differ as to the exact dividing line between normal and abnormal pressure. My own feeling is that, other things being equal, a pressure over 145 is abnormal. At the age of fifty a pressure of over 150 is pathologic. This does not mean that the patient is gravely ill, but it does mean that such a patient should be kept under observation and that the cause of the rise in blood pressure should be ascertained, for when it comes to arterial disease—particularly hypertension—prevention is better and easier than cure.

As guardians of the health of our patients we are not doing our full duty. We are still too much concerned in treating the sick; a laudable purpose in itself, but one not exhausting our possibilities for good. I need not discuss the utility of preventive medicine in general. We are all agreed on that. What I have particularly in mind is personal preventive medicine. By that I mean that we should make it our duty toward our individual patients and families to guard them against such ill health as timely examinations can anticipate. To this end we should urge the men and women of over forty years of age to send urine for examination two or three times a year and to have their blood pressure taken twice a year. If we can once induce those whom we should be called upon to treat if they were ill to see the value of such examinations to themselves, our usefulness to the community and our prestige, which many new creeds and fancies have somewhat impaired, would be greatly enhanced. I see no reason why medical officers of health should not add to their preachments about communal prophylaxis, appeals for personal prophylaxis against insidious diseases of non-infectious nature which when once detected are often beyond cure.

To return to our subject: When I stated above what I considered the limits between normal and abnormal blood pressure I was giving the results of personal experience and belief. I am in the habit of looking on a pressure of from 140 to 150 in a man aged between thirty and forty years as not altogether normal if it is found on several examinations, especially if the diastolic pressure is raised 20 or 30 mm. Here I must emphasize one point to which I have already alluded: under excitement or fear, or after a heavy meal, or after exercise, the pressure rises temporarily, at times as much as 50 mm. Due allowance must be made for such transitory variations. Only when the pressure is sustained at the same level under proper conditions of testing is it significant.

When we consider the causes of high arterial pressure we enter a field with few well-defined paths. Bright's disease, particularly

the chronic interstitial variety, bears an unquestionable relationship to hypertension. But in what way the lesion of the kidney acts to bring this about is far from settled. Permanently high blood pressure is produced not only by the chronic interstitial form, the parenchymatous type also raises the blood pressure. I believe in such cases that estimation of the the blood pressure is often of great diagnostic and prognostic import. If we could explain the hypertension in nephritis we should also know the causes of the hypertrophy of the heart that is an almost constant feature of this affection. It may be remembered that the early view was that the restriction of the vascular area in the diseased and contracted kidney was responsible for the rise in blood pressure. This can scarcely be the case in view of the great adaptability of the circulation to slowly developing conditions; moreover the kidney circulation bears but a small ratio to the general vascular territory, and the local pressure restriction seems hardly capable of influencing general pressure to any marked degree.

Another view is that the disease of the kidney increases the viscosity of the blood, and hence the internal friction, and as a corollary the pressure against the vessel walls. It is quite possible that such heightened viscosity may be a factor, but the pressure is also raised under conditions in which the viscosity is presumably lessened: in chronic parenchymatous nephritis with dropsy and hydremia.

The theory that hypertension in nephritis is due to a contracted state of the vessels, the result of a generalized exaggeration of the vasomotor tonus, has had strong attractions for recent writers. It may be expressed by saying that in chronic nephritis some pressor substance circulates in the blood; either a new one or a previously existing one in increased quantity, which causes a spasm of the vessels. I see no flaw in this hypothesis except that the pressor substance is not unequivocally demonstrated. Many believe that it is adrenalin or epinephrin. While a number of investigators have found the adrenalin increased in nephritis, others have not. If there is an excessive amount in the blood, a hyperadrenalinemia, it remains yet to be explained why the adrenalin content is increased. Inasmuch as some recent investigators have found a pressor substance in the kidney itself, it is possible that through the melting down of renal tissue in Bright's disease such a substance may be liberated and taken up by the blood. Quite recently attention has been turned upon the liver in Bright's disease, as the belief is growing that the relation between that organ and the kidney is far closer than physiologists have held. It is to me not inconceivable that some of the symptoms of nephritis are connected with disturbed hepatic function. An attractive hypothesis could be erected on the theory that the kidney is an organ of internal secretion, but the paucity of facts does not warrant it. It can be

seen then how far we are from a real knowledge of the cause of hypertension in Bright's disease.

Another cause of persistent hypertension is arteriosclerosis. So much has been said and written on this subject that I shall not discuss the clinical causes or the pathology. Let me state only that arteriosclerosis is both a general and a local process. Local arteriosclerosis, which may often be intense, is not necessarily accompanied by a rise in blood pressure. Thus we may have marked calcification and beading of the accessible arteries without hypertension, and, on the other hand, I have seen a considerable number of patients with impalpable arteries whose pressure was 200 mm. or more. These are the cases that are difficult to interpret. Sometimes careful and repeated examination of the urine will show evidence of chronic interstitial nephritis: abundant urine of subnormal specific gravity with a trace of albumin and a few hyaline casts. In others the urine is entirely normal. At times the quantity is slightly increased and a few hyaline casts are found in the centrifuged specimen. I lay no stress on a sparse number of casts, especially if the urine contains crystals of uric acid and oxalate of lime.

Now it is this particular group of hypertension cases to which I have just referred that is of interest and importance; the group without notable thickening of the superficial arteries and no renal changes of importance. It is common in men and comprises, in my own experience at least, a rather large proportion of women of middle age. Not until I began to look for it did I realize how common this non-sclerotic type of hypertension is in the female sex. Both the men and women with this affection are usually robust, stout to obese, and past fifty years of age. In none of my cases in women was syphilis or alcohol a factor. In men syphilis at times plays a part, but I do not think that alcohol is to be blamed. I do not mean to say that these patients do not drink, but I wish to convey the idea that I do not consider alcohol itself an important feature in the production of high arterial tension. In the majority of cases there had been mental strain and heavy responsibility. Some of the women had reared large families under difficulties. One curious circumstance may not be without significance. Nearly all the women had come, after years of privation, to live in comparative comfort because their sons, several of them physicians and lawyers, had been successful, and had dutifully made life easy for their mothers.

The symptoms complained of were usually respiratory or gastric in nature; rarely such as to direct attention to the heart and vessels. I have no statistical tables, but I have gained the impression that one-half to two-thirds came complaining of indigestion and bloating after meals. A majority of the remainder noticed shortness of breath on exertion, which they were inclined to ascribe

to distention with gas. A few were first troubled with vertigo, with numbness and tingling of the extremities, or with ringing in the ears. The women in this group have interested me particularly because in few of them had the real nature of the affection been suspected. They had usually been treated for stomach trouble—flatulent dyspepsia or nervous indigestion.

Now what do we find on examination? The men are usually overweight, with large and solid-looking chests. They have an air of youthfulness and often much vitality. The women are large and have heavy, pendulous breasts. The heart is found enlarged, often far beyond what one would expect from either the symptoms or the physical appearance and capacity of the patient. The radials are either soft as in youth or a trifle thickened, like a thin-walled rubber tube. The temporals, which are rarely conspicuous in women, may not be abnormal. An arcus senilis is often present. The urine may not show anything of importance except a slight increase in quantity. The specific gravity will not vary much from the normal, but there is one factor of importance that I have noticed quite recently since my attention was called to it by Dr. Pratt, of Boston—namely, that these patients pass much larger amounts of urine during the night than in the daytime. I have a patient under observation at present who voids sometimes twice as much at night as in the daytime, the urine being measured separately from 8 A.M. to 8 P.M., and from 8 P.M. to 8 A.M. The blood pressure will be found high—from 190 to 260 or even more—far beyond what would be expected from an examination of the arteries.

The hypertrophy of the heart, which is always present, is not due to valvular disease. There are no endocardial murmurs except perhaps late in the course, when through loss of compensation the heart dilates and a mitral systolic murmur appears. Usually, indeed, almost without exception, the second aortic sound is much accentuated, and the first sound at the apex dull and heavy. The heart is generally regular. This type of hypertrophy is frequently overlooked, as I have had occasion to notice both in undergraduate and in postgraduate teaching. It is overlooked because many of us fail to palpate and to percuss the heart. I am inclined to believe that percussion and palpation of the heart are more important than auscultation.

Not rarely there is a systolic murmur at the aortic area without concomitant signs of aortic stenosis. The murmur indicates, I take it, sclerosis in the arch of the aorta. It is customary to make light of this murmur; justly so in the case of arteriosclerosis; but in the group with which I am dealing, in which there is no sclerosis in the peripheral vessels, the murmur, to my mind, has an important meaning. I believe the patients that have it are more liable to angina pectoris. This brings me to another important point

of interest: these high-pressure cases that do not have visible or palpable arteriosclerosis during life are particularly prone to anginal attacks, to coronary sclerosis and thrombosis. A systolic murmur at the aortic area in such a patient is ominous of an early extension of the sclerotic process from the arch into the coronary artery; its presence therefore influences the prognosis.

The blood pressure, as I have said, is high, often startlingly so, in patients whose complaints are seemingly trivial. Thus I have under my care at present a widow, aged forty-seven years, with a systolic pressure of 265, soft arteries, a perfectly regular but enlarged heart, whose chief complaint is ringing in one ear. Not a few cases have been referred to me by ophthalmologic friends who detected retinal hemorrhages. Such hemorrhages, or rather the visual disturbances dependent upon them, are often the earliest symptoms of which the patient is cognizant. Ophthalmologists have learned to recognize these high-pressure cases by means of the ophthalmoscope. Many patients, however, have normal eye-grounds.

The course of this affection, which I have been bold enough to designate *high-pressure hypertrophy*, is largely governed by the state of the heart. As long as the latter is competent the circulation is maintained at its high level, often with a minimum degree of functional disturbance. Eventually, however, the *vis a fronte* becomes too great for the *vis a tergo*, and the heart yields and dilates. The subsequent events are practically identical with those of decompensation from any other cause, and need not detain us. No doubt the lessening of the resilience of the vessels and their failure to help in the proper movement of the blood is an important contributing factor in the downward course of events.

I have been impressed with the infrequency with which high-pressure cases suffer from apoplexy. It occurs, but more often in the younger than in the older patients. Death results either from total failure of compensation or from angina pectoris, unless some intercurrent malady anticipates these two.

What is the cause of this intereating syndrome—this high-pressure hypertrophy? At first sight it looks as if there must be some pressure-raising substance in the blood. I have been hoping that some method of detecting this could be adapted to clinical application so that the theory might be tested. At present the methods are too complicated. In many cases there is, I believe, arteriosclerosis of certain important vascular territories—namely, the aortic arch and the splanchnic vessels. How sclerosis of the former raises pressure, if it does so, is a mystery. I am not sure that the ingenious hypothesis of Bittorf solves it.[2]

[2] Bittorf believes that a possible cause of high arterial pressure is degeneration of the depressor nerve or its terminations in the arch of the aorta. The depressor nerve is an afferent nerve carrying impulses to the brain, in response to which the peripheral arterial pressure is lowered through vasodilatation. When the nerve is diseased the system naturally loses this important "factor of safety."

Sclerosis of the splanchnic vessels, on account of the great area of this system, is undoubtedly capable of raising the pressure. It is likewise possible that with sclerosis of this territory some changes take place in the suprarenal glands by which the blood pressure is affected. At any rate, sclerosis of the splanchnic vessels is not uncommon, and perhaps some of the gastric distress and abdominal pains of which the patients complain may find their explanation on that basis.

I shall not dwell on the hypertension accompanying the more obvious types of arteriosclerosis. The clinical differences are not great and the diagnosis is much easier. Angina pectoris is not so common with pipe-stem peripheral arteries; apoplexy is more frequent.

TREATMENT. The treatment of hypertension is a subject of great practical importance upon which there is as little unanimity as upon most other subjects of medical practice. I have already discussed means of prevention, an object possible of accomplishment when the taking of blood pressure becomes a habit and when the laity learn to realize the importance of paying for medical advice before it is imperative to have it.

It should be borne in mind that the high pressure, like much of Nature's work in the body, is compensatory and reparative. Hence any attempt to depress the blood pressure to its normal for the individual is both irrational and harmful. All that we may safely attempt to do is to lower the blood pressure when it is excessively high to a point where symptoms cease and to keep it there. Serious consequences have followed when a pressure of 240, for example, was knocked down medicinally and precipitately to 150. Let us see what we can do to lower hypertension to a reasonable level. If we knew the direct cause we might combat it. As we do not know it we must work indirectly. First and foremost in my mind is rest, mental rest being more important than physical rest, although the latter has its place. It is astonishing what relief from the "weariness, the fever and the fret" will accomplish. Sometimes driving a patient to make a decision in a critical matter, so as to have it over with, accomplishes more than any medicine.

The diet is of importance, but more from the point of view of quantity than of quality. Many patients with hypertension have a habit of overeating, and suffer from what Sir Clifford Allbutt calls "hyperpiesis." And it may be wise to restrict somewhat the nitrogenous, more particularly the purin-containing foods. A valuable admonition is that the patient should eat a small evening meal—he will rest much better. In regard to stimulants, I am more afraid of tobacco than of alcohol, but usually restrict both, as the case may require. I do not think tea or coffee is good for these patients, a fact they often discover for themselves. The bowels must be kept open. No one remedy or measure can be employed for all cases. The salines are useful. Many persons

get comfort from a pill of phenolphthalein and rhubarb, or from the well-known compound liquorice powder. An occasional dose of calomel or blue mass serves a useful purpose. Special baths are of doubtful value, and I question particularly whether the Turkish bath so frequently employed does any good. A simple hot bath or a short electric cabinet bath may at times be of benefit, but the latter ought not to be left to the uncontrolled discretion of the patient.

Electricity in the form of the high-frequency current (auto-condensation) has a growing number of advocates. My use of this is of such recent date that I have no personal opinion.

As for drugs, even the laity are familiar with the value of the nitrites, and are no longer frightened when nitroglycerin is prescribed. There are cases in which nitroglycerin fails. In these cases sodium nitrite in doses of from $\frac{1}{8}$ to 2 or even 3 grains may prove useful. Erythrol tetranitrate is a powerful vasodilator in doses of one-half grain, but often produces a painful fulness in the head, to which patients object seriously. The nitrite group of remedies is to be used only to relieve symptoms, which they often do—especially nocturnal dyspnea—in a remarkable manner. The continued use of the nitrites is of doubtful utility unless the pressure is rising, or there is angina pectoris, or marked dyspnea. In such cases they may be given over a long period in large doses.

The iodides are much in use. I give them routinely, though their method of action is unknown. Perhaps they reduce the viscosity of the blood. I prefer the sodium salt given two hours after meals, in water or milk. I find the newer iodine-containing tablets convenient, especially for persons who travel.

Digitalis might appear to be contraindicated in the cases of hypertension with which I am dealing, but strange as it may seem, many patients who are suffering from dyspnea and even from vertigo do well on small doses of digitalis. I prefer either the tincture in from 5 to 10 mm. doses three times a day, or the powdered leaves ($\frac{1}{4}$ to 1 grain).

There is one more measure in the value of which I have an abiding faith—namely, venesection. At the Philadelphia General Hospital venesection never went entirely out of use, and in the last score of years it has again become popular and is winning its way into general practice. It is safe to abstract in such cases up to a pint of blood, and if the pressure instrument is kept on the arm and the pressure controlled, we may take off 20 or 24 ounces. The relief from symptoms is often magical.

A number of European health resorts enjoy a great popularity in the treatment of hypertension and other cardiovascular conditions. Personally I doubt whether there is anything specific in their waters or in their baths; but freedom from care, regular hours, and greater frugality of living are probably the factors that achieve the good results.

A CLINICAL STUDY OF THE COAGULATION TIME OF BLOOD.

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We have felt for some time the need of a clinical method for determining the coagulation time of the blood which would be more satisfactory than the numerous methods previously used. The various ones which we have tried have proved unreliable in our hands. Cohen,[1] in a very complete paper on the "Coagulation Time," has discussed thirty-one methods and their modifications, and we would refer for full bibliography to his paper. Nearly all these methods fail to recognize what physiologists[2] have demonstrated long ago—namely, that contact with tissue markedly accelerates the coagulation time of the blood.

It is not our purpose to touch upon the various theoretic considerations of the coagulation of the blood or constituents of the blood necessary to coagulation, but mention must be made of the valuable work of Howell,[3] whose theory of the coagulation of blood seems to satisfy all requirements.

Pratt,[4] in 1903, writing from the Medical Clinic of Tübingen, embodied experimentally one of the chief principles of our method, although he used the Pratt-Grützner coagulometer. He speaks of finding the coagulation time of blood taken directly from the arm vein of man to average from six to seven minutes normally. He writes as follows in regard to it: "Coagulation time can be determined with a fair degree of accuracy by this method, but as it involves the withdrawal of the blood, directly from the veins, it was not considered feasible." At the present day, when paracentesis of the veins is done so commonly and easily, it is no longer a difficult or dangerous procedure.

Morawitz and Bierich,[5] in 1907, published from Krehl's clinic a method of determining coagulation time in cholemic cases which closely resembles our own. Ten c.c. of blood were taken from an arm vein, 5 c.c. of this were put into test-tubes, which were watched for coagulation, and the remaining 5 c.c. were used for special examination of blood elements. Their series were apparently

[1] Archives of Internal Medicine, 1911, viii, 684.
[2] Howell, W. H., Text-book of Physiology, 1905, p. 418.
[3] Loc. cit.
[4] Jour. Med. Research, 1903, No. 1, x, 120.
[5] Arch. f. experiment. Pathologie and Pharmakologie, 1907, lvi, 115.

limited to the cholemic cases and their method was not generally adopted.

Addis,[6] in 1910, wrote of using a method of studying the coagulation time in hemophilia similar to that of Morawitz and Bierich, except that 2½ c.c. instead of 5 c.c. of blood were used for the test. Inversion of the tubes into which the blood was put showed the end-point.

Holmgren,[7] in 1912, found that Schultz's method of using blood obtained by skin puncture was unsatisfactory, and therefore recommends venous puncture for obtaining blood for determination of coagulation time by a special coagulometer.

Dochez,[8] at the Rockefeller Institute, has been using during the period of our study a method similar to ours, but more accurate and correspondingly less practical clinically. In a series of cases of pneumonia, acute and convalescent, Dochez has determined the coagulation time by withdrawing about 7 c.c. of blood from an arm vein into a syringe, emptying this blood into a carefully prepared test-tube, and then watching for the end-point by tilting the tube every thirty seconds. The test-tube is kept at 37° C.

Thus although the method to be described is not completely new, it has been used on so small a scale and in such limited series as to justify a more extended study.

Method. One c.c. of blood is withdrawn from an arm vein, using a small all glass syringe (for example, Burroughs and Wellcome, 20 minims), preferably with a platinum needle, the syringe having been first sterilized and rinsed out with normal salt solution. The time at which the blood is withdrawn is noted as accurately as possible; the needle is removed and the syringe is then emptied into a small glass tube (Widal tube), about 8 mm. in diameter, which has previously been rinsed out in normal salt solution. The tube is rotated endwise every thirty seconds, and that point at which the blood no longer flows from its position but maintains its surface contour when inverted is taken as the end-point. Care must be used to exclude air bubbles, as they tend to accelerate coagulation.

Observations as to the nature of the clot and of the time and extent of its retraction have been included as an important part of the method. We have controlled nearly all our cases with the coagulation time by Hayem's[9] method, blood being obtained by a puncture of the ear with a mechanical lancet of uniform length (5 mm.). The blood used was also collected in a Widal tube as quickly as possible, and in as nearly uniform bulk as possible (that is 1 c.c.). It usually required more than one-half minute to collect this amount even after deep puncture. Our comparative results have shown the unreliability of the ear method. For example, a

[6] Quarterly Jour. Med., iv, 16; Jour. Path. and Bact., 1911, xv, 427.
[7] Münch. med. Woch., October 15, 1912, No. 42, p. 2281.
[8] Jour. Exper. Med., xvi, No. 5, p. 693.
[9] Paris, 1889, p. 323.

case of hemophilia gave a coagulation time of fifty minutes by the arm-vein method, but blood from the ear clotted in five minutes. The blood coagulated by this method (of Hayem) very uniformly between two and five minutes, with only four exceptions—namely, purpura hæmorrhagica, family type of Hanot's cirrhosis, gallstones, with marked jaundice and hemophilia. The longest time was twelve and one-half minutes in one case of hemophilia. In all four of these cases the coagulation time by the arm-vein method was also prolonged. Our only conclusion is that if the coagulation by using the blood from the ear is over five minutes, one would also find the coagulation time by using the arm vein prolonged, but negative results are of no value.

The advantages of the arm-vein method over those ordinarily used are briefly as follows: Blood is obtained directly from the blood stream without contact with tissue or skin, which contact must enter in as a factor of varying importance in the coagulation time of blood taken by skin punctures, as has been the procedure in nearly all previous methods. It has often been found that blood flowing freely from deep punctures clots much more slowly than blood expressed from shallow punctures, apparently because of the varying proportions of blood and tissue juice.[10] It is obviously difficult to make punctures every time of equal depth and in tissue of equal vascularity. Therefore the results are not strictly comparable.

Another important advantage over some of the methods described previously is the simplicity of our method, the coagulometer consisting merely of the syringe and the Widal tubes. Moreover, the end-point is usually quite definite and the element of personal equation is less than in most other methods.

After the coagulation time has been determined we still have a considerable clot to study as to its character, color, and retraction, which can hardly enter into the methods where but one or two drops are studied.

The disadvantages are as follows: One is the ratio of the amount of foreign surface to the bulk of blood. This ratio is quite large in our method, but the glass syringe and tube are as smooth and clean as possible and coated with normal salt solution. We consider that much of this disadvantage is obviated. Moreoever, the fact that like all methods this method is not absolute but only relative, practically rules out the argument of surface and volume ratio.

The discomfort to the patient of puncture of a vein for the blood is slight, as a rule, and has been no more disagreeable than the ear puncture. Moreover the blood may often be obtained for the test at the same time that blood is being taken for a blood culture, Wassermann, or other tests, a larger syringe being used, and a slight error thus introduced.

[10] Howell, W. H., Amer. Jour. Physiol., October 1, 1912; Text-book on Physiology, 1905, p. 418.

Temperature has an important bearing on the coagulation time, as has already been indicated by Addis,[11] Wright,[12] Brodie and Russell,[13] Cohen,[14] Morawitz and Lissen,[15] and others.

We have studied the coagulation time in 3 cases—2 normal and 1 with gastric ulcer—at varying degrees of temperature, using water baths to maintain the temperature about the Widal tubes. The results are shown by the three curves (Fig. 1).

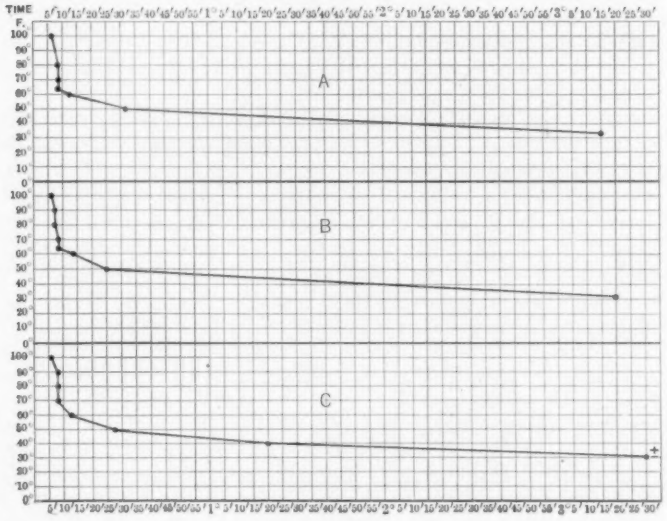


FIG. 1.—Relation of temperature and coagulation. *A*, healthy case; *B*, case of peptic ulcer; *C*, healthy case.

These curves indicate that if the test is done at a room temperature of 65° to 90° F., the error, although present, is within one minute, and may be neglected. However, if the temperature is below 65° or above 90° F., a warm or cool water bath should be used, maintaining a temperature of 70° F. as mean. The tests of coagulation time which we have done in summer and autumn have been in a ward with a temperature range of 65° to 90° F. The addition of an incubator, as in Dochez' method, between the degrees of 65° and 90° F. would detract from the practicability more than it would add to the accuracy.

Hinman and Sladen,[16] in 1907, showed that the coagulation time of blood from the same person varied considerably with the time of day. In a case tried by our method we found little or no

[11] Quarterly Jour. Exper. Phys., 1908, i, 305. [12] British Med. Jour., 1894, i, 237.
[13] Jour. Phys., London, 1817, xxi, 403; K. Burker, Pflüger's Archiv, 1904, cii, 36.
[14] Loc. cit. [15] Deut. Arch. f. klin. Med., 1908, xciv, 110.
[16] Bull. Johns Hopkins Hosp., xviii, 207.

variation in the coagulation time of blood taken morning, afternoon, and evening. At 8.45 A.M., just after breakfast, the time was eight minutes; at 12 M., just before dinner, it was eight minutes; at 4.15 P.M. (before supper) it was seven and one-half minutes, and at 7.30 P.M. it was eight minutes. Thus at times during the day when coagulation would ordinarily be tested our method shows sufficient uniformity.

The results of observations of the coagulation time with the method just described on 125 cases of all kinds are shown in the accompanying table.

TABLE OF COAGULATION TIMES.

Disease.	No. of cases.	Average, arm vein.	Average, ear.	Limits, arm vein.	Limits, ear.
Normal	24	6½	3	5 - 8	2 - 4
Pernicious anemia	12	10⅜	3+	5 -15	2 - 4½
Secondary anemia from gastric ulcer	4	8	3½	5 -14	2 - 5
hemorrhage	..	.....	.....	4 - 8	
Chlorosis	2	6			
Polycythemia	1	6	3		
Splenic anemia	1	15	3¾		
Myelogenous leukemia	3	6	3½	3 -10	3 - 4½
Lymphatic leukemia	1	10	3½		
Purpura hæmorrhagica	1	12½	6½	10 -15	4 - 9
Hemophilia	2	52½	12½	55 -50	5 -20
Diabetes (one with acidosis)	3	5·	3	3½- 7	2 - 3
Catarrhal jaundice	3	8 (-)	3 (-)	7 - 8½	2½- 3
Cancer of liver with jaundice	4	5¼ (-)	4	5 - 6½	2½- 4
Cancer of liver without jaundice	2	8	3¼	7 - 9	3 - 3½
Gallstones with marked jaundice	2	11¾	4½	8 -15½	3½- 5½
Syphilis of liver with jaundice	1	9	3¼		
Syphilis of liver without jaundice	1	7	3		
Atrophic cirrhosis with jaundice	1	10	2		
Atrophic cirrhosis without jaundice	2	4¾	2¼	4 - 5½	2 - 2½
Hypertrophic cirrhosis with jaundice	2	14½	7	12 -17	5 - 9
Hypertrophic cirrhosis, with jaundice, family type, toxic	1	6	2½		
Infections:					
Pneumonia	6	15½	4	6½-35	3½- 4½
Typhoid	16	7+	2¾	2½-15	1½- 4½
Streptococcic septicemia with arthritis, endocarditis, and pericarditis	1	11½	–	–	
Staphylococcus aureus, septicemia, and pyemia,	1	13	–	–	
Brill's disease	1	2¼	1¾	–	
Acute infection	5	6	3	4 -10½	2½- 4
Gonorrheal arthritis	1	5½	–	–	–
Endocarditis	4	6½	2½	2½-11½	1½- 3
Tænia	1	5	2¾	–	
Trichiniasis	1	10½	–	–	
Cardiorenals and cardiac decompensation	6	5¾	3½	4½- 6½	3¾- 5
Aortic disease	3	4½	3	4 - 5	2½- 3½
Nephritis with edema	3	9+	3	5½-14	3
Gastric ulcer (bleeding) with anemia	4	8	3½	5 -14	
Gastric ulcer (bleeding) without anemia	1	8	–	8	
Hyperthyroidism	1	7	2½	–	
Hemoptysis in tuberculosis	2	6¾	3½	8 - 5½	

Discussion of results in clinical cases:

Normal Coagulation Time. We have found the *normal* coagulation time of blood taken by this method to be six and one-half minutes as averaged from twenty-four healthy persons, the limits being five and eight minutes. The normal average for blood from the ear was three minutes, with two- and four-minute limits, thus showing that blood obtained by skin puncture and contaminated by tissue-juice clots twice as rapidly in the normal individual as blood taken directly from the vascular system.

Accelerated Coagulation Time. Acceleration of the coagulation time (three and one-half minutes or less) was found in some cases, notably in 5 patients with typhoid fever, 4 of whom developed thrombosis. There were a number of isolated cases which showed a hastened coagulation time, including 1 of the 3 cases of myelogenous leukemia, 1 of the cases of diabetes, 1 case of typhus fever, and 1 of endocarditis.

Delayed Coagulation Time. Of the 125 cases, delay of the coagulation time occurred in 47, which may be divided into three main groups—blood diseases, jaundice, and acute infections.

Blood Diseases. Two cases of hemophilia had markedly prolonged clotting time, the longest in the series, almost an hour; both had hemorrhages. One case of purpura hæmorrhagica had delayed coagulation time, the first result being ten minutes; two and one-half weeks later the test gave fifteen minutes (the patient had grown worse steadily and died a week after the second test).

Cases of primary pernicious anemia varied considerably in coagulation time, although the average time (ten minutes) was longer than normal. Those cases that were the sickest had the most delayed coagulation time, and two cases with a coagulation time of fifteen minutes died.

One case of splenic anemia, a fatal case of acute lymphatic leukemia, and one case of myelogenous leukemia without hemorrhage showed delayed coagulation times (ten to fifteen minutes). Two cases of myelogenous leukemia were not delayed.

Liver Diseases and Jaundice. Jaundice and liver cases varied considerably in coagulation time, those with only slight jaundice being practically normal, while those with marked jaundice were often delayed. One striking case with gallstones and complete jaundice had a coagulation time of fifteen and one-half minutes, and died of secondary hemorrhage soon after operation. Another clinically similar case of gallstones, with complete jaundice, had a coagulation time of eight minutes before operation, and had no hemorrhage. Cases of syphilis and atrophic cirrhosis of liver with jaundice were above normal limits, while similar cases without jaundice were normal. Cancer of the liver even with jaundice did not retard the coagulation time in four cases. Hanot's cirrhosis

of the family type, with slight to moderate jaundice, showed in two cases a marked delay in coagulation time, twelve to seventeen minutes. Both cases (sisters) had hemorrhage. One died of spontaneous hemorrhage from mucous membranes in spite of transfusion.

Acute Infections. Of acute infectious diseases, lobar pneumonia gave the most prolonged coagulation time (average fifteen and one-half minutes). One of the six cases that was very sick had blood which took thirty-five minutes to clot. One mild case was normal (six and one-half minutes). In convalescence from pneumonia the coagulation time approaches the normal again as shown by several of our cases, especially a very severe one with a delayed time of thirty-five minutes, which became six minutes several days after crisis. This return to normal after retardation in pneumonia has been well shown by Dochez.[17]

Of the 16 cases of typhoid, 7 had delayed coagulation time (eight to fifteen minutes); 2 of the 7 had hemorrhages, 1 dying; 4 cases were normal, and the other 5 hastened; 4 of the latter had thrombosis, as we have noted above. Dr. Oscar Richardson in an unpublished study at the Massachusetts General Hospital found that blood taken from the heart of typhoid fever patients at autopsy varied enormously in the coagulation time. In general, the cases with hemorrhage gave a prolonged coagulation time, and the cases with thrombosis an accelerated coagulation time.

One of the typhoid cases with definitely prolonged coagulation time in the acute stage of illness became normal in convalescence (thirteen minutes to seven minutes), another dropped from nine minutes to seven minutes.

Other septicemias besides pneumonia and typhoid tend to show abnormality in coagulation time. Staphylococcus aureus and streptococcic septicemia seem to delay clotting, as found in two cases (thirteen minutes and eleven and one-half minutes respectively).

Other mild acute infections showed little change in coagulation time. Three cases of acute endocarditis, one dying soon after, gave times rather shorter than normal.

Cardiac and gastric cases studied were normal. Severe nephritis gave in one case a definitely prolonged coagulation time (fourteen minutes), and in another, a fatal case, with marked edema, a coagulation time of eight minutes.

Hemoptysis in tuberculosis in two cases was not accompanied by prolonged coagulation time.

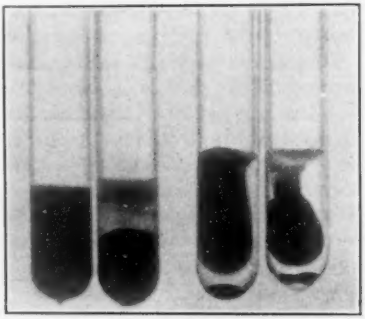
Menstruation in 3 cases did not prolong the coagulation time. In 1 case with nose bleed the coagulation time was delayed during menstruation; 250 cases tested by Keller[18] during, before, and

[17] Loc. cit.

[18] Arch. f. Gyn., Part 3, xcvii, 540.

after menstruation showed no change in coagulation time. Pregnancy and menopause he also found did not effect the coagulation time.

In general, the coagulation time corresponded closely to the clinical picture of hemorrhage. The test was of distinct prognostic value in cases of jaundice undergoing operation. In pernicious anemia and certain other blood diseases a further delay in coagulation time was synchronous, with aggravation of symptoms. In the acute infections, excluding typhoid, the more severe infections seemed to be associated with a more delayed coagulation time. In typhoid fever there seemed to be a distinct parallelism between thrombosis and hemorrhage and the coagulation time. This question must be subjected to further study.



1 2 3 4

FIG. 2.—1, normal clot before retraction; 2, hemophiliac clot before retraction; 3, normal clot after retraction; 4, hemophiliac clot after retraction.

The study of the nature and retraction of the clot has been interesting. There have been 35 cases out of the 125 which we have tested in which there has been more or less settling of the red blood corpuscles. Of these, 31 have had definitely long coagulation times and 3 others on the border-line of normal. The most marked settling of corpuscles occurred in 6 cases, in which the coagulation time was twice normal or more. In 1 case (a patient with hemophilia) the corpuscles settled so much before coagulation that they made up but one-quarter of the bulk of the blood. In this case the coagulation time was more than eight times normal. In another case of hemophilia the corpuscles settled to about one-half the bulk, as shown in the accompanying illustration (Fig. 2).

The colorless clot above the corpuscles is evidently produced by the differences in specific gravity of the blood elements, and is the so-called "buffy-coat" described by Davy[19] and Dalton[20] in

[19] Researches, 1839, ii, 46.

[20] Treatise on Human Physiology, 1859, p. 195.

the first half of the last century. There were 47 cases with delayed coagulation time. Only 12 showed no settling of the corpuscles, and they were no longer than ten minutes at the most. A few of the 12 gave a clot of flimsy texture. As a rule therefore the delay in coagulation time goes hand-in-hand with the settling of the corpuscles and "buffycoat," and the two may almost be used as a check on each other. If either one or other is present the blood tested is not normal, but the usual combination of the two is conclusive.

Retraction of the Clot. There were but three cases in which no retraction of the clot took place. These were a fatal case of purpura hæmorrhagica, tested twice, a case of pernicious anemia, and a fatal case of jaundice and cholemia of unknown etiology.

Relation of the Coagulation Time to the Retraction of the Clot. The coagulation time in these three cases was twelve and one-half minutes, thirteen and one-half minutes, and seven minutes respectively. The various other cases with a delayed coagulation time showed a normal retraction of the clot, consequently the retraction of the clot did not seem to depend upon the mere delay in the coagulation time.

Relation of the Number of Blood Platelets to the Retraction of the Clot and to the Coagulation Time. The blood platelets were almost entirely absent in the case of purpura hæmorrhagica, as has already been pointed out by Denys,[21] Hayem,[22] and Duke.[23] The blood platelet count in the case of pernicious anemia was 1000. There was no examination of the blood platelets in the third case. Other cases with considerably decreased platelet counts showed fairly consistently delay in clot retraction. On the other hand, one case of hemophilia had a blood platelet count of 200,000, and retraction was normal. The problem of the relation of the blood platelets to the retraction of the clot is now being studied further, but in general these cases tend to suggest that the blood platelets have more to do with the retraction of the clot than with its actual formation, as has already been pointed out by Duke.[24]

The color abnormalities observed have been chiefly three: The lighter color of the blood in severe anemias, the chocolate-brown color in leukemia, and the definitely yellow serum expressed from the retracting clot in cases of jaundice and pernicious anemia.

SUMMARY. A simple method of determining the coagulation time of blood has been studied. It obviates the contact of blood with tissue juice which introduces a larger element of error. The method seems reliable in ordinary room temperatures. In cases tested the tendency to bleed corresponded closely to the coagulation time.

[21] La Cellule, 1887, vol. iii; 1889, v, 189.
[22] Presse Méd., 1895, p. 233.
[23] Arch. Int. Med., November 15, 1912.
[24] Loc. cit.

THE VALUE OF MASSAGE IN THE TREATMENT OF VARIOUS DISORDERS IN CHILDREN.

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The purpose of this paper is to call attention to the value of massage in the treatment of malnutrition, rickets, and various other disorders in children. In adults we have recourse to this form of treatment in affections of the heart; in conditions of malnutrition, with flabby muscles, as in the various types of anemia; in convalescence from acute diseases, operations, or parturition; in the treatment of sprains and fractures; in affections of the joints, muscles, and nerves; and in constipation. In children, however, this valuable therapeutic measure has been largely neglected, and yet the results obtained in the majority of cases are better than in the adult. The operator must not only be patient and skilful, but should also have had considerable experience in the nursing care of children. The latter I have found exceedingly important, and I have been fortunate in having had for this work a trained nurse who had several years' experience in the nursing of children before taking up the study of massage.

Many observers have noted the fact that babies in hospitals, but especially in foundling asylums, do not thrive as well after they have reached a certain period in convalescence from acute illness as they do under less favorable circumstances in their own homes. The reason for this is not difficult to determine In the majority of hospitals the baby is left in the cot all day, often with the bedclothes tucked in so snugly that the movements of the arms and legs are greatly impeded, the respiration and circulation are sluggish, so that he will not thrive so well as if he were picked up at the times of nursing and allowed to move his arms and legs more freely. In some hospitals this "mothering" of babies is considered an essential part of treatment, but usually the inadequate number of nurses prevents it being properly carried out. For babies convalescing from illness in hospitals or homes, or cases of malnutrition, massage is of great value, and excellent results have been reported by MacPhail.

Massage mechanically excites the vessels to action, hastening the circulation and emptying the lymph vessels. Thus the nourishment of the muscle cells is improved by forcing out the waste products and keeping then bathed in a constantly renewed stream of arterial blood. The rate of the heart beat and respiration are slightly accelerated. In fact all the bodily functions are stimulated to increased activity.

The question might well be asked: "Do children not object to

this form of treatment?" This depends largely upon the personality of the masseuse, but in my experience, after the first treatment, the child seems to enjoy the manipulation.

The duration of the treatment should not be more than twenty or thiry minutes, and during the first two weeks should be given daily. Subsequent to this three times a week is sufficient.

It is in cases of malnutrition, with loss of appetite, weak flabby muscles, and distinct pallor that the best results are noted. This is best illustrated by the following case.

M.M., aged twenty-two months, came under observation in July, 1910, and at that time weighed thirteen pounds and eleven ounces. She has been nursed until six months old, and was then given modified milk. At one year she weighted twenty-one pounds. During the next five months her weight remained about the same; her diet consisted of milk, orange juice, cereal, soft egg, broth, and junket, and she showed some growing disinclination to eat. Dentition was normal, and at fourteen months she began to walk. From the seventeenth to the twenty-second month the appetite grew less until she took less than ten ounces of food in twenty-four hours. Her physician made various changes in her diet without any benefit. During the last two weeks before I saw her she had been fed on oatmeal water, but of this she took only a small quantity. As soon as food was offered to her she would "gag" and attempt to vomit. Her face became drawn so that she looked like a withered old woman; she was pale and emaciated and muscles flabby, and there was some edema of feet and hands. The case was considered to be one of anorexia nervosa. During the first six weeks feeding with a catheter was resorted to, using a formula of three parts milk and one part water, and during that time she gained steadily, weighing fifteen pounds and two ounces. She then began to take her milk herself, and by November 10 weighed nineteen pounds and four ounces. She then contracted a severe bronchitis, with high temperature, and gradually lost weight until December 5, when she weighed sixteen pounds and twelve ounces. She took her food poorly, and there was considerable undigested fat in the stools, so that the percentage of fat in her milk was reduced to 2. During the next five weeks there was no gain in weight; her muscles became more flabby, and on January 10, 1912, without changing her diet in any way, massage was started. She at once showed improvement, so that at the end of one month she weighed nineteen pounds and thirteen ounces, a gain of three pounds and one ounce. During the next month she gained four pounds, her muscles became firm, she lost her irritability, and from that time on she thrived, so that now at four years she weighs forty-one pounds.

In another patient, aged ten months, in whom the weight had been stationary for two months, the muscles flabby, and an anemia

present, so that the red blood corpuscles numbered 3,900,000 and hemoglobin 60 per cent., massage was started without making any change in diet. During the first month there was an increase in weight from sixteen pounds and two ounces, to eighteen pounds and twelve ounces, and at one year she weighed twenty pounds and twelve ounces. The red corpuscles at that time numbered 4,850,000, and the hemoglobin was 90 per cent. The most noticeable thing in this case was the increase in the amount of food taken within three days after massage was started.

Great benefit is obtained in the treatment of rickets from massage. In these cases the muscles are flabby, the circulation is sluggish, and the extremities emaciated. Because of the weakened condition the child takes no exercise, and with massage properly given the muscles become firm, the circulation is improved, and the extremities become stronger, so that the child itself will take more exercise. Furthermore, many of the deformities, such as bowing of the legs, can be prevented or corrected.

By massage combined with other exercises I have also seen complete correction of the deformity due to scoliosis before there was little or any change in the vertebræ.

In poliomyelitis after the acute stage has passed, massage has been used with such marked benefit that it is now looked upon as the most important therapeutic measure available for the treatment of the paralyzed muscles. I should like to call attention to its use in the prevention of the spastic contractures in cases of polioencephalitis or other conditions in which there is upper neurone destruction. The following case illustrates this very well:

K. B., aged five years and nine months, first came under observation in September, 1908. At that time, when she was eighteen months old, she had a severe attack of polioencephalitis, with right-sided convulsive twitchings, which kept up for twelve hours, and a temperature of 104°. The next day she had complete hemiplegia of the right side, with aphasia. During the next four days the temperature gradually returned to normal, but the aphasia and hemiplegia persisted. At the end of two weeks, as soon as the sensitiveness of the right arm and leg would permit, massage was started, and has since been continued every morning until the present time, by the mother, who after the first two weeks of treatment learned to give it herself. There was steady improvement, so that at the end of four months she could walk, and there has never been any evidence of spasticity in the right arm and leg. At the present time, with the exception of some of the finer movements of the fingers, she can use the right arm as well as the left, and both the right arm and right leg measure a trifle more than the left.

For a long time massage has been regarded as a useful therapeutic agent in constipation in adults, but seldom do physicians

resort to it in children. From a thorough trial I am convinced that it is just as useful in children as it is in adults.

Another group of cases in which massage is useful is in nervous children. Much can be accomplished by putting them to bed, carefully supervising the diet, and resorting to massage to keep up the nutrition. It is astonishing to see the improvement in a period of two weeks.

In cardiac lesions in children the result of acute rheumatism, the necessity of keeping these cases at rest for many weeks and months, in order to allow the heart muscle to regain its tone, is imperative. These patients will get up much stronger if after the febrile period has passed they are given massage, with first passive and then resisted movements.

Many other conditions might be mentioned where massage is useful, but in general the indications for its use are the same as in the adult, and the results are equally as good.

SOME HEMATOLOGICAL FINDINGS IN PELLAGRA.[1]

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Introduction. The material upon which the following report is based was obtained from cases of pellagra which were sent from the field headquarters of the Commission at Spartanburg, South Carolina, together with slide specimens of pellagrous blood taken from cases in South Carolina and forwarded for study to the New York Post-Graduate Medical School and Hospital during the summer and early fall months of 1912. In spite of the fact that the number of cases under consideration at that time was not large, nevertheless, it seemed advisable to record briefly the most important points in connection with the work that had already been done.

The blood was examined with a view of determining the hemoglobin content, the number of red and white cells per cubic millimeter, the differential leukocyte count, and at the same time the general morphologic characteristics of the blood in stained preparations. A few observations were also made on the coagulation time.

A review of the literature on this particular phase of the hematology of pellagra reveals an agreement of opinion in regard to the presence of a mild degree of secondary anemia of the chlorotic type

[1] This is the first of a series of reports of work performed under the auspices of the Thompson-McFadden Pellagra Commission of the Division of Tropical Medicine, Department of Laboratories, New York Post-Graduate Medical School and Hospital, ultimately to be issued as a complete volume by the Commission.

without any marked structural or tinctorial alterations in the red corpuscles unless the anemia is pronounced. The majority of investigators state that the total leukocyte count varies, and that occasionally a leukocytosis exists which in most instances cannot be accounted for by the presence of a definite complication. The differential leukocyte count has apparently proved to be the most interesting and variable feature, and, judging from the available data, a fairly constant departure from the normal seems to be found in a large number of cases. Lavinder, in 1909, found "a relative large mononuclear increase with an absence of eosinophilia, except in cases with such complications as roundworms or hookworms." Sambon, working in Italy, also noticed a relative increase of the large mononuclear leukocytes. Contrary to these findings, Buhlig at the Peoria State Hospital, failed to demonstrate any increase in the large mononuclears. Bardin, quoted by Niles, found in uncomplicated cases of pellagra a lymphocytosis, with a corresponding reduction in polynuclears and a marked reduction in eosinophiles. Lavinder states that Fiorini, Gavini, and Masini in Italy found a decided eosinophilia. In the recent work of the Illinois Pellagra Commission no significant changes were observed in the differential leukocyte count.

Technique Employed. The blood was taken for examination in the midforenoon or midafternoon. The percentage of hemoglobin was estimated with the Sahli hemoglobinometer, two "readings" being made and the results averaged; this method was found quite satisfactory. The erythrocytes were counted with a Thoma-Zeiss apparatus, using a dilution of 1 to 200 and counting the corpuscles on the four corner "blocks" of twenty-five small squares in two drops. The average was then taken and the number of cells per cubic millimeter computed on this basis. In estimating the number of leukocytes a Zappert-Ewing chamber was used, thus affording an opportunity of counting 9 square millimeters in one drop. Two such determinations were made from a dilution of 1 to 20 in a "Rieder" pipet and the average taken; the usual calculation was then made. A difference of not more than twenty cells per field (high power) in the red count and eight cells per field (1 square millimeter, low power) in the white count was permissible. If a greater discrepancy existed a third drop was usually sufficient to rectify it, in either count.

For differential leukocyte counting films were made on clean, new slides, and a preparation selected in every case, on which the distribution of the corpuscles was moderately thin. Five hundred cells were counted over the midportion of each slide, care being taken not to encroach too closely on the ends, where frequently there is a relative increase in the more bulky leukocytes. The blood was stained with Wright's modification of Leishman's polychrome eosin-methylene blue mixture. The following classification was

adopted: polynuclear neutrophiles, small lymphocytes, large lymphocytes, large mononuclears, transitionals, eosinophiles, and mast cells. Differentiation between the small and large lymphocytes was to a certain extent unsatisfactory, inasmuch as intermediate gradations in size were occasionally encountered. Mononuclear cells measuring 12 to 15 microns in diameter, and having a comparatively wide zone of protoplasm, were classified as large lymphocytes; these were generally found to contain round nuclei staining not quite so intensely as the nucleus of the small lymphocyte. The large mononuclear leukocyte was recognized by its size, being two to three times that of a red blood corpuscle and containing a pale oval nucleus, frequently eccentric in position; the protoplasm was usually abundant, and feebly basic. It was realized that distinction between these two cells is a matter of no little difficulty, and depends to a large extent upon the personal equation, which forms an important factor in this much-debated question in the cytology of the blood. The reason for attempting to classify these types separately arose from the desire to ascertain whether the so-called large mononuclear leukocyte exhibited any relative or absolute variation from normal limits.

The patients examined were divided into two groups, A and B. Under Group A were included those cases that were under observation in the hospital at the time the examinations were made. These patients received no medicine, and were allowed a liberal diet. In Group A the hemoglobin percentages were determined, the red and white cells counted, and differential leukocyte counts made; this series of investigations is designated as "complete blood counts." As will be seen in Table I, several such complete counts were made on most of the cases. Under Group B (Table II) are included those cases in which only differential leukocyte counts were done, it not being convenient to make a more detailed examination at the time.

Analysis of Findings. In Table I the hemoglobin percentages show considerable variability, ranging from 58 to 107 per cent., with an average of 83 per cent. The erythrocytes are not markedly decreased, the lowest number being 3,920,000 per c. mm. As will be observed, several counts are 5,000,000 and over, the highest figure being 5,440,000. This occurred in the only male patient of the group, and was associated with a moderate reduction of the hemoglobin (65 per cent.). The patient was a poorly nourished individual, who was suffering from a mild attack of pellagra of about one year's duration. The majority of the members of this group appeared decidedly pale and anemic, according to general clinical criteria, and it was a matter of surprise to note the comparatively slight reduction in erythrocytes and hemoglobin that existed. The average red-cell count was 4,758,000 per c.mm.

TABLE I (GROUP A).—COMPLETE BLOOD COUNTS.

No.	Date.	Sex.	Age.	Hemoglobin. Per cent.	Erythrocytes. Per c.mm.	Color index.	Leukocytes. Per c.mm.	Differential leukocyte counts.												Stage of disease and clinical remarks.
								Polynuclears.		Small lymphocytes.		Large lymphocytes.		Large mononuclears		Transitionals.		Eosinophiles.		Mast cells.		
								Per cent.	No.	Per cent.	No.	Per cent.	No.	Per cent.	No.	Per cent.	No.	Per cent.	No.	Per cent.	No.	
	1912																					
1	June 4	F.	36	70	5,290,000	0.6	6,300	49.60	3125	40.00	2520	3.00	189	3.40	214	0.60	38	3.00	189	0.40	25	First attack, severe; duration, three weeks; watery diarrhea; strongyloides intestinalis numerous in stool.
	June 15			85	5,430,000	0.7	7,000	52.80	3696	27.20	1904	6.20	434	2.60	182	1.60	112	8.00	560	1.60	112	
	June 24			85	5,200,000	0.8	7,400	43.60	3227	40.00	2960	10.00	740	1.20	89	1.40	103	3.40	251	0.40	30	
	July 1			83	5,140,000	0.8	9,000	59.30	5337	24.60	2214	8.70	783	2.00	180	0.70	63	3.70	333	1.00	90	
	July 23			88	5,060,000	0.8	9,100	47.40	4313	42.00	3822	2.80	255	2.80	255	2.00	182	2.40	218	0.60	55	
2	June 4	F.	17	60	4,620,000	0.7	8,300	71.00	5893	18.00	1494	2.20	183	3.00	249	2.20	182	3.00	249	0.60	50	Recurrent attack, severe;[1] duration, three weeks.
	June 14			84	4,640,000	0.9	8,800	50.40	4435	33.40	2940	5.80	510	1.80	158	4.20	370	4.00	353	0.40	35	
	July 1			87	4,700,000	1.0	8,200	63.40	5199	21.20	1738	5.40	443	3.60	295	1.40	115	4.40	361	0.60	49	
3	June 4	M.	60	65	5,440,000	0.6	6,500	66.60	4329	24.00	1560	1.40	91	4.20	273	2.00	130	1.40	91	0.40	26	First attack, mild; duration, one year.
	June 12			98	5,040,000	1.0	7,100	55.80	3962	35.00	2485	1.60	114	4.40	312	1.40	99	1.60	114	0.20	14	
	June 19			95	5,000,000	0.9	8,000	55.00	4400	31.00	2480	6.75	540	2.00	160	1.00	80	3.75	300	0.50	40	
	June 25			93	4,900,000	0.9	7,200	62.00	4464	27.40	1972	4.80	346	2.00	144	0.80	58	2.60	187	0.40	29	
4	July 6	F.	40	105	4,000,000	1.3	8,000	41.15	3295	37.00	2960	13.35	1068	4.35	348	2.25	180	1.90	153	....	..	Recurrent attack, mild; duration, two and one-half months.
	July 16			100	4,560,000	1.0	7,200	55.00	3960	33.00	2376	2.20	159	4.20	303	1.60	115	3.60	259	0.40	29	
	July 27			102	5,100,000	1.0	10,000	45.50	4550	39.00	3900	8.20	820	5.50	550	1.30	130	....	....	0.50	50[2]	
5	July 6	F.	32	98	4,200,000	1.1	10,000	41.60	4160	42.30	4230	9.70	970	2.70	270	2.20	220	1.40	140	0.10	10	Recurrent attack, severe; duration, two months.
	July 16			102	4,250,000	1.2	8,000	50.20	4016	36.40	2912	5.40	432	3.20	256	0.40	32	4.40	352			
	July 27			107	4,400,000	1.2	11,000	56.50	6215	28.00	3080	6.50	715	5.00	550	1.00	110	3.00	330			
6	July 31	F.	18	88	4,800,000	0.9	9,000	69.00	6210	21.60	1944	4.40	396	1.80	162	1.40	126	1.80	162	....	..	First attack, mild; duration one month; no intestinal parasites found in stools.
	Aug. 8			86	5,000,000	0.8	14,000	60.20	8420	21.40	2996	5.60	784	3.40	476	1.40	196	7.80	1092	0.20	28	
7	July 31	F.	20	91	4,800,000	0.9	13,000	56.60	7358	37.20	4836	2.80	364	2.00	260	0.20	26	1.20	156			First attack, mild; duration, two weeks.
	Aug. 8			81	4,800,000	0.8	9,000	58.80	5292	32.00	2880	2.40	216	0.60	54	0.60	54	5.40	486	0.20	18	
8	July 17	F.	36	100	4,500,000	1.1	12,000	71.20	8544	15.00	1700	5.40	648	5.60	672	1.40	168	1.00	120	0.40	48	Recurrent attack, mild; duration, 3 weeks.
	Aug. 8			90	5,000,000	0.9	16,800	76.40	12835	16.20	2721	1.20	202	3.00	504	1.20	202	2.00	336			
9	Aug. 8	F.	28	78	4,800,000	0.8	10,000	60.00	6000	32.00	3200	3.00	300	1.00	100	1.00	100	3.00	300	....	..	Recurrent attack, severe; duration, 3 mos.
10	Aug. 4	F.	38	67	5,000,000	0.6	14,400	78.60	11318	17.20	2477	1.80	259	0.80	115	....	....	1.20	173	0.40	58	First attack, mild; duration, one month; chronic pulmonary tuberculosis.
	Aug. 17			70	4,320,000	0.8	11,000	66.25	7288	22.50	2475	2.50	275	1.00	110	4.50	495	2.50	275	0.75	82	
11	Sept. 7	F.	43	58	4,410,000	0.6	10,800	68.60	7409	26.60	2872	1.80	194	0.20	22	0.20	22	2.00	216	0.60	65	Recurrent attack, mild; duration, five months.
	Sept. 17			85	3,920,000	1.0	16,000	61.80	10358	32.00	5312	2.80	465	1.60	267	1.40	232	0.40	66			
12	Sept. 12	F.	34	65	5,400,000	0.6	18,000	72.60	13068	18.60	3348	3.20	576	1.00	180	2.40	432	2.20	396	....	..	Recurrent attack, mild; duration, four months.
	Sept. 24			100	4,380,000	1.1	9,100	61.30	5578	31.50	2866	3.50	319	1.30	118	1.50	109	0.90	73			
	Sept. 28			97	4,140,000	1.1	12,700	64.20	8143	26.40	3353	4.00	508	2.00	254	1.20	152	1.80	229	0.40	61	
	Average		33	83	4,758,000	0.8	10,403	59.13	4887	29.36	2828	4.63	446	2.59	252	1.50	144	2.73	263	0.34	31	

[1] The term "severe" implies the presence of gastro-intestinal symptoms, nervous manifestations, and extensive skin lesions.
[2] Two hundred and twenty leukocytes counted.

TABLE II (GROUP B).—DIFFERENTIAL LEUKOCYTE COUNTS ONLY.

No.	Sex.	Age.	Polynuclears.	Small lymphocytes.	Large lymphocytes.	Large mononuclears.	Transitionals.	Eosinophiles.	Mast cells.	Stage of disease and clinical remarks.
1	M.	23	52.80	34.40	1.20	1.60	1.00	9.00	....	Recurrent attack, severe; duration, one month; stools not examined.
2	F.	34	59.20	32.00	2.40	2.40	2.00	2.00	....	First attack, severe; duration, one month.
3	F.	30	56.00	32.00	3.40	1.00	0.40	7.20	....	Recurrent attack, mild; duration, two months; stools not examined.
4	F.	19	56.00	33.40	1.80	2.00	1.80	5.00	....	First attack, mild; duration, one month; no intestinal parasites found in stools.
5	F.	40	66.00	28.00	4.00	1.00	....	1.00	....	First attack, mild; duration, two months.
6	F.	35	69.80	23.60	2.20	2.40	0.60	1.20	0.20	First attack, mild; duration, one month.
7	F.	26	49.20	39.00	4.00	1.40	1.60	3.40	1.40	Recurrent attack, mild; duration, two months.
8	F.	21	50.00	40.20	4.20	2.60	1.20	1.60	0.20	First attack, severe; duration, one month.
9	F.	30	60.60	32.80	2.80	2.60	0.40	0.80	....	First attack, severe; duration, two months.
10	F.	38	58.40	31.60	4.00	1.60	2.00	2.40	....	Recurrent attack, mild; duration, two months.
11	F.	38	56.80	31.60	2.40	2.80	2.00	4.00	0.40	Recurrent attack, mild; duration, four months.
12	F.	30	51.20	36.40	4.40	2.40	2.40	3.20	....	First attack, mild; duration, two months.
13	F.	35	61.00	30.60	4.40	2.40	1.00	0.60	....	First attack, mild; duration, two months.
14	F.	36	56.40	35.00	4.20	1.40	1.20	1.80	....	Recurrent attack, mild; duration, two months.
15	F.	27	34.80	50.40	5.20	4.80	0.40	2.80	1.60	Recurrent attack, mild; duration, five months; recovering.[4]
16	F.	44	37.80	40.40	10.00	4.80	0.40	5.60	1.00	Recurrent attack, mild; duration, one month.
17	F.	32	47.60	40.40	5.20	1.20	2.00	2.60	1.00	First attack, mild; duration, three months; recovering.
18	F.	36	62.60	26.00	3.00	0.20	0.40	7.80	....	Recurrent attack, mild; duration, four months; recovering; no intestinal parasites found in stools.
19	F.	28	68.00	21.80	3.40	2.00	1.00	3.80	....	Recurrent attack, severe; duration, five months.
20	M.	25	62.00	27.00	6.00	....	1.00	3.00	1.00	Recurrent attack, mild; duration, three months; recovering.
21	M.	36	57.00	31.00	5.00	0.50	1.50	5.00	....	Recurrent attack, mild; duration, six months.
22	F.	34	50.00	33.00	8.00	5.00	1.00	2.00	1.00	First attack, mild; duration, one month.
23	F.	19	55.00	38.00	4.00	1.00	0.20	1.00	0.80	Recurrent attack, mild; duration, three months; recovering.
24	M.	35	50.00	41.00	5.00	3.00	1.00	....	....	First attack, severe; duration, two months; recovering.
25	F.	32	64.00	23.00	7.00	1.00	....	4.00	1.00	First attack, mild; duration, four months.
26	F.	26	56.00	32.00	8.00	0.80	0.80	2.00	0.40	Recurrent attack, mild; duration, two months.
27	F.	40	60.00	30.00	7.00	2.00	....	1.00	....	First attack, mild; duration, three months.
28	M.	22	54.00	38.00	6.00	1.00	....	1.00	....	First attack, severe; duration, two months.
29	F.	48	63.00	25.00	8.00	....	1.00	3.00	....	Recurrent attack, severe; duration, three months
30	M.	39	54.60	32.40	5.20	1.20	0.60	6.00	....	First attack, mild; duration, five months; stools not examined.
31	F.	40	58.00	30.00	6.00	3.00	....	3.00	....	Recurrent attack, mild; duration, four months; recovering.
32	F.	34	60.00	27.00	8.00	3.00	....	2.00	....	First attack, mild; duration, two months.
33	F.	17	37.50	44.00	10.00	4.50	0.50	3.00	0.50	First attack, mild; duration, two months.
34	F.	38	73.60	20.00	3.20	1.00	1.00	1.20	....	First attack, severe; duration, four months.
35	F.	22	58.20	28.60	7.20	2.00	1.00	3.00	....	First attack, severe; duration, one month.
36	M.	58	60.20	26.20	9.40	2.00	....	2.20	....	First attack, severe; duration, five months.
37	M.	8	54.40	32.00	9.60	2.00	1.00	0.60	0.40	First attack, severe; duration, three months; recovering.
Average		29	56.00	32.37	5.28	1.98	0.87	2.94	0.26	

[4] The term "recovering" means that the patient had no active signs or symptoms of pellagra when the blood was examined.

The color index was 1 or 1 plus in twelve determinations, the highest index being 1.3. In twenty instances it was under 1, the lowest being 0.6; the average index was 0.8. A careful examination of the stained blood films exhibited practically no changes in size, shape, or coloring of the red cells; nucleated corpuscles were never seen nor were there any staining variations from the normal, such as polychromatophilia and basophilic granulation. The average leukocyte count was 10,403 per c.mm., a trifle above the maximum normal. A slight or moderate leukocytosis existed in severe cases at some time during their residence in the hospital. No complications could be discovered in these patients. One patient with chronic pulmonary tuberculosis and much emaciation had a leukocytosis of 11,000 to 14,000; she had an irregular temperature, not exceeding 100.2° F. All the other cases were afebrile, and frequently had subnormal temperatures.

The differential leukocyte count revealed an absolute polynucleosis in those cases associated with a leukocytosis of over 10,000, except in one instance. Three of these cases, however, showed a slight relative decrease in the polynuclears. Out of thirty-two differential counts in this group, twenty-four gave a relative and, in addition, an absolute lymphocytosis, including under this term both small and large forms of lymphocytes. The average total lymphocytosis of the series was 33.99 per cent. The average large mononuclear count was 2.59 per cent. The highest percentage recorded was 5.5 per cent. The transitional forms average 1.5 per cent. These last two types taken together (Ehrlich's classification) form 1 to 6 per cent. of the leukocytes in normal blood; therefore, from the above figures it cannot be said that they show any constant alteration from the normal. The average eosinophile count of 2.73 per cent. is within normal limits. A few cases showed slight eosinophilia, the highest being 8 per cent. in which patient strongyloides intestinalis were found in the stools.

The coagulation time was determined in the first three cases with a Brodie-Russell coagulometer and was found to be six minutes and twenty seconds, four minutes and eight seconds, four minutes and twenty-five seconds, respectively, all of which readings are within the normal range for this instrument.

Table II. The differential leukocyte count on a series of slides taken from 37 cases at their homes in South Carolina was carefully determined without discovering any essential variation from the average results obtained in Group A. The average lymphocytosis of 37.65 per cent. is a little higher than in the previous group.

SUMMARY. From a consideration of the above data it is evident that there occasionally exists in pellagra a variable degree of chloranemia, which, however, is not a prominent feature of the attack. The disease, apparently, may be present for some time without leading to any anemic changes. Whether the anemia is due to the actual

existence of pellagra, or is the result of an indefinite train of antecedent conditions extending over a period of time before the inception of the disease, is difficult to say. On the other hand, many cases are perfectly well up to the onset of the attack.

One of the most noteworthy features in connection with the leukocytes is the not infrequent presence of a leukocytosis, which appears to be inexplicable in the light of our present knowledge of the disease. This might suggest the possibility of an infectious etiology of obscure origin, or may be due to complicating disturbances. The lymphocytosis is interesting and is probably in accordance with the general cachectic condition of most pellagrins who are also often the subjects of gastro-intestinal disorders.

This investigation would seem to indicate that there are no characteristic or constant variations in the large mononuclear leukocytes and eosinophiles.

The writer wishes to thank Drs. P. S. Barrett, R. M. Brown, S. S. Irwin, and E. Kister, of the resident hospital staff, for assistance in making the blood examinations.

COMPLETE HEART-BLOCK, WITH RAPID IRREGULAR VENTRICULAR ACTIVITY.

By Selian Neuhof, M.D.,

ADJUNCT ATTENDING PHYSICIAN, LEBANON HOSPITAL, NEW YORK.

The following case of heart-block presents unique and unusual features which warrant its report:

History. L. W., aged twenty years; born in the United States; the oldest of three children; entered the surgical wards of the German Hospital February 20, 1912.[1] His family history presents nothing abnormal. He had an attack of scarlet fever and diphtheria about five years ago, from which he recovered entirely. Except for two mild attacks of gonorrhea, the last one occurring one year ago, he had been absolutely well until six months before admission. At that time he began to complain of indefinite abdominal symptoms. He had constipation, nausea, anorexia, and general abdominal pains, usually more marked on the right side; fever and night sweats. He lost about forty pounds in weight. There was occasionally a dry cough, but no expectoration. For two years he had been in the habit of counting his pulse, and he says that until his present illness it had always been between 70 and 80.

[1] I am indebted to Dr. Willy Meyer and Dr. M. Rehling, Attending and Adjunct Surgeons to the German Hospital, New York, for permission to study and report this case.

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Physical Examination. On the left side of the neck, partly beneath the sternomastoid muscle, there was a single gland about the size of a walnut, movable and somewhat tender. The gland had been enlarged several months. It did not resemble the ordinary tuberculous glands of the neck. The von Pirquet test was positive, and the Wassermann reaction negative. The urine was normal. The blood pressure usually ranged about 120 mm. Hg. systolic and 105 diastolic. Before operation the rectal temperature ranged from 101° to 103°.

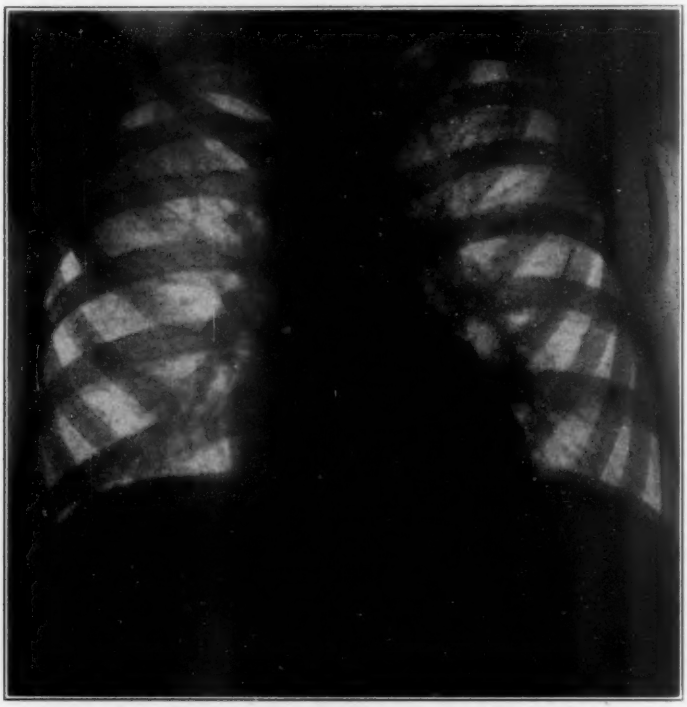

FIG. 1.—*X*-ray of chest, showing advanced shadows about root of the lungs, particularly on the left side.

Lungs: Many examinations of the lungs showed no abnormal physical signs; no rales; no areas of dulness; no signs of tuberculous infiltration. Röntgenograms of the chest (Fig. 1), on the other hand, showed abnormal shadows about the root of the lungs, particularly on the right side. These infiltrated areas were apparently deep-seated, and this fact probably accounted for the lack of abnormal physical signs. The pictures also showed infiltrating areas in the upper lobe of the left lung.

Heart: The apex beat was forcible, somewhat diffuse, situated in the fifth intercostal space, 8.5 cm. from the middle of the sternum, and just within the nipple line. The right border of cardiac dulness was about 1 cm. from the right sternal border. Orthodiascopic examination also showed the heart borders to be normal in size and form. There was a soft systolic murmur accompanying the beginning of the first sound at the apex and a marked roughening of the first aortic sound. At the root of the neck there was a frequent vigorous jugular pulsation. The radial pulse was regular, except for occasional shorter beats, and often so dicrotic as to give the impression that a premature contraction (extrasystole) had occurred. The apex impulses represented beats, all of which were transmitted to the wrist. Upon admission to the hospital his pulse was 50. During his stay and after his discharge from the hospital his pulse was usually 48 to 54; it was occasionally 42, and sometimes 70. Though weak and febrile the patient was able to walk fairly well. There was no dyspnea; no dizziness; no edema of the ankles; no evidence of decompensation.

His abdomen was tense; ascites was present; irregular doughy masses were felt in both hypochondria. A diagnosis of tubercular peritonitis was made.

Laparotomy was performed by Dr. Willy Meyer March 9, 1912. About a pint of sanguineous peritoneal fluid escaped. The cecum was indurated and studded with tubercles. There were many hard and large nodes in the mesentery; a piece of one of them was removed for microscopic examination; this showed "numerous isolated tubercles of typical structure, consisting of caseous centres of various sizes, surrounded by layers of epithelioid cells, among which are found numerous Langerhans gaint cells."[2] No radical operation was attempted. The postoperative course was disturbed by a femoral thrombosis lasting two weeks. After operation the temperature gradually fell, so that when the patient left the hospital it ranged between 100° and 101°. Since then (May 21, 1912) his rectal temperature has not been over 100°. He has felt stronger, but occasionally has complained of slight abdominal pains. He has gained twelve pounds in weight. At the last examination (May 31, 1912), except for a slight soft impurity of the first sound at the apex, the heart sounds were normal. Tracings taken in February, 1913, showed that complete heart-block was still present.

During the patient's stay in the hospital, polygraphic tracings were made almost daily, twice before and after the administration of atropine. Many tracings have been taken since, and on two occasions electrocardiographic curves were obtained during the administration of atropine. Digitalis has not been given at any time.

[2] Report from the Pathologic Department of the German Hospital.

Polygraphic Tracings. Tracings showing complete *A–V* dissociation are reproduced in Fig. 2. Instead of the normal succession of *a–c–v* waves corresponding to the normal sequence of the cardiac cycle, there is absolute independence of the auricular and ventricular contractions. The auricular beats (*a* waves) occur at regular intervals, but have no fixed sequential relation with the ventricular beats (*c* waves). The *a* waves precede, coincide with, or succeed the *c* waves. Radial tracings (Fig. 3) taken during the operation also suggest that complete heart-block was present at that time, as the rate and arrhythmia were the same as when complete heart-block is known to have existed. The tracings also show alternation (*R,R'*, Fig. 3).

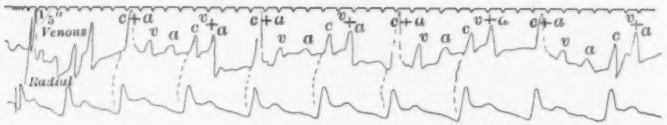

FIG. 2.—Complete block; marked dicrotic notch in radial.

FIG. 3.—Radial pulse during operation.

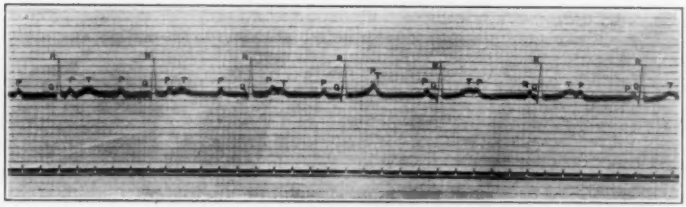

FIG. 4.—Complete dissociation.

Electrocardiographic Curves.[3] Electrocardiagrams (leads 1, 2, 3) were taken before atropine was injected. During the period of atropine poisoning only the second lead was taken. The galvanometric curves (Fig. 4) just as did the polygraphic tracings, showed complete dissociation. Sometimes the *P–R* interval (corresponding to the *As–Vs* interval) was small, sometimes large, and occasionally the *P* and *R* coincided. At times the *P* and *T* waves fell together, producing summation waves of different sizes.

[3] I am indebted to the Cardiographic Department of the Rockefeller Hospital for taking these curves and for cooperation in the study of this case.

Discussion of the Polygraphic and Electrocardiographic Curves. The usual ventricular rate in complete heart-block is between 25 and 35. Rates of 60 have been described by Windle,[4] but they are rare. In the case of heart-block reported by Hay[5] and later by Hay and Moore,[6] when the ventricular rate was 80, the block was relieved and the auricles and ventricles beat coördinately. In heart-block and auricular fibrillation incident to digitalis poisoning a rate of 70 has been reported by Mackenzie[7] and one of 90 by Lewis.[8] In incomplete heart-block associated with auricular tachycardia the ventricles also beat rapidly. Such cases were first reported by Herts and Goodhart,[9] Rihl,[10] Cohn,[11] and Lewis.[12] During the first atropine administration in the case now reported the ventricular rate was also unusually high, varying from 54 to 77, while the auricular rate ranged from 108 to 124. The auricular and ventricular rates in the second atropine test varied respectively between 95 and 115 and between 50 and 69. During these periods the ventricular contractions were irregular. This irregularity was occasionally felt by palpating the pulse, and was also seen in the polygraphic tracings when atropine had not been given. An arrhythmia of this type is often the result of premature contractions originating at some point other than that in which the rhythmic ventricular beats are being generated. The aberrant origin of such beats is detected by the difference in shape of the electrocardiographic complexes between the usual and unusual beats. The shape of the electric complexes of all the beats in this case, however, was identical, indicating that they had a common origin. After the administration of atropine the interventricular interval (R–R) was for the most part fairly uniform, being about one second; shorter intervals varied from 0.686 second to 0.851 second. It was found in the shorter beats that the time between the R waves and P waves immediately preceding them was in every instance but one between 0.1 and 0.2 second (Table I): that is to say, the P–R time in these cycles fell within normal limits. Taken by themselves it would appear that these shortened ventricular intervals resulted from contractions stimulated by the preceding auricular contractions. As they occurred after the administration of atropine the conclusion seemed warranted that the degree of heart-block had been decreased by the removal of the depressing influence of the vagus nerves on conduction, and that occasionally

[4] Heart, i, 2.
[5] Lancet, January 20, 1906.
[6] Ibid., November 10, 1906.
[7] British Med. Jour., 1911, ii, 872.
[8] Heart, iii, 284.
[9] Quart. Jour. Med., 1908–1909, ii, 213.
[10] Zeitschr. f. exp. Path. u. Therap., 1911, ix, 277.
[11] Jour. Exper. Med., 1912, xv, i, 50.
[12] Heart, iii, 299.

stimuli generated by auricular contractions were able to pass over the conducting system and to originate ventricular contractions. These stimuli reached the ventricles before their time for rhythmic contraction and apparently resulted in sequential heartbeats. In the second test made at a later date the short ventricular cycles also appeared, but the relation between the *P* and *R* waves already described did not recur. It appears therefore that short ventricular beats can occur, that ventricular arrhythmia results, and that the arrhythmia may be independent of impulses descending from the auricle. The origin of the shorter beats in the first experiment may have been accidental. No positive conclusion was drawn as to the degree of block that was present. The occasional presence of 2 to 1 heart-block (Fig. 5, Table II) is only apparent, and is due to the ventricular rate being at times one-half of the auricular. Continuations of such tracings soon show complete block when the auricular or ventricular rates begin to vary. The

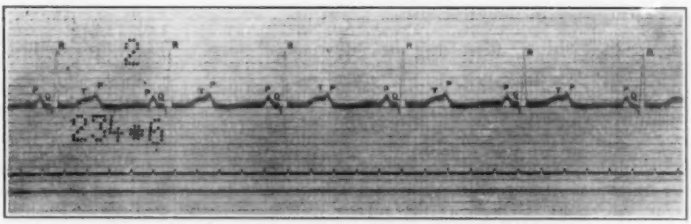

FIG. 5.—Apparent 2 to 1 block in this portion of the tracing.

atropine had a marked effect in increasing the ventricular and auricular rates in the first administration and a less marked effect on the ventricular rate in the second. On this occasion measurement of the curves showed a peculiar auricular rhythm; there were alternate short and long interauricular (*P–P*) intervals (Table II).

The cause of heart-block in this case is difficult to determine. A syphilitic lesion involving the *A–V* bundle can be excluded because of the absence of any syphilitic manifestations and of a positive Wassermann reaction. The patient never had rheumatism, and so inflammatory infiltration of the conduction system is likewise excluded. The favorable progress of the patient makes it seem unlikely that a neoplasm involved the atrioventricular bundle. The history suggests a direct connection between the onset of tuberculous peritonitis and of heart-block. The Röntgenograms show abnormal shadows at the pulmonary hilus, representing enlarged lymph nodes. The nodes are probably tuberculous. An extension of the tuberculous process to the heart is possible. A few cases of solitary tubercles in the heart have been published.

In one Tabora and Tilp[13] describe a pulse rate of 48. There is no reason to believe that diffuse tuberculous myocarditis is present in this case, but the suspicion that a solitary tubercle is pressing upon or destroying the *A–V* bundle cannot be dismissed.

The radiographic shadows in question may represent mediastinal nodes, and it may be that these exert pressure on the deep cardiac plexus and its branches. This plexus, consisting of branches from the vagus and sympathetic and sending filaments to the heart, is located over the bifurcation of the pulmonary artery, posterior to the arch of the aorta and anterior to the lower end of the trachea; the two distinct portions—right and left—are united around the lower end of the trachea. What effect such compression may have in causing heart-block cannot be stated.

Summary and Conclusions. A case of complete heart-block with rapid arrhythmic ventricular action is recorded. Atropine was administrated upon two occasions. The first time the block was probably relieved; at the second it was not. The rate of both auricles and ventricle was increased. The electrical complexes of all the ventricular cycles, long and short, were identical. It is concluded therefore that ventricular arrhythmia not due to ectopic ventricular contractions may occur in heart-block, assuming the block to be complete. The cause of the block and the exact nature of the lesion has not been ascertained. It is supposed that a factor besides that due to the vagus nerves is involved in the production of block.

I wish to express my indebtedness to Dr. A. E. Cohn and Dr. G. C. Robinson for valuable assistance in the study and preparation of this case.

TABLE I.

Cycle	Q-Q Interval.	P-Q Interval.	P-P Interval.
3– 4	.965	.466	.516
4– 5	**.750**	**.125**	.508
5– 6	.988	.522	.600
6– 7	**.784**	.255*	.547
7– 8	.964	.063	.655
8– 9	.965	.495	.500
9–10	**.712**	**.121**	.533
10–11	.964	.539	.564
11–12	.988	.417	.547
12–13	**.755**	**.104**	.564
13–14	.971	.666	.564
14–15	**.732**	**.158**	.562
15–16	.966	.041	.625
16–17	.956	.400	.500
17–18	**.686**	**.100**	.545
18–19	.964	.500	.627

In all the tables the measurements are given in fractions of seconds.

[13] Strassburger med. Zeit., 1908, Heft 3.

Shorter beats and normal *P–Q* intervals (between 0.1 and 0.2 seconds) are in heavy figures.

With one exception (marked *) *P–Q* intervals of short beats are normal.

TABLE II. CURVE, FIG. 5.

Cycle.	Q-Q Interval.	P-Q Interval.	P-P Interval.
1	1.190	.055	.600
2	1.193	.041	.600
3	1.160	.051	.566
4	1.175	.043	.600
5	1.150	.048	.566
6	1.148	.051	.606
7	1.176	.042	.575
8	1.166	.050	.600
9	1.175	.046	.575
10	1.188	.050	.600
11	1.181	.054	.537
12	1.178	.030	.602
13	1.200	.050	.588

Auricular about twice the ventricular rate; no short ventricular beats.

Auricular rhythm shows alternating long and short beats.

THE ACUTE EFFECTS OF CAISSON DISEASE OR AEROPATHY.[1]

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OF all the occupational diseases which follow in the train of advancing civilization, together with development of arts, sciences, and industries, none is of greater interest, none more dramatic in its manifestations, than the oftentimes tragic effects of the illness to which men are liable who work in compressed air in diving, or in subaqueous construction of tunnels, jetties, foundations for bridges, etc.

A man in all the vigor of health and strength descends to his daily task in the river tunnel; enters the compressed air; works his regular shift of three or four hours; comes out through the air lock by the ordinary method of decompression; ascends to the street and starts for home, feeling perfectly well.

Fifteen minutes later, without the slightest warning, he is attacked with intense boring pains in his legs and abdomen; or,

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he staggers and falls helpless to the ground, paralyzed from his waist down. Fortunate he is if efficient treatment be near at hand, and by recompression in the medical air lock, his pains vanish, his paralysis disappears, and on the morrow he returns to his work as usual.

The evolution of theories and devices to enable man to subsist for a time under water begins with the age of Aristotle and Alexander the Great, and constitutes a fascinating study; but the first authentic mention of caisson disease is due to Trieger, the French engineer, who first successfully operated a practical caisson in 1839.

The material for this paper is mainly drawn from the writer's own experience of two and one-half years as a member of the medical staff in attendance during the construction of the East River tunnels from New York to Long Island City, the largest single enterprise ever attempted under compressed air, in which more than 10,000 men were employed and 3,692 cases of illness were reported by the medical director, Dr. F. L. Keays.

To designate the train of symptoms resulting from work in compressed air various terms have been used, for example, "caisson disease," "divers' palsy," "compressed-air illness or sickness," "bends," etc.

In an earlier paper I ventured to employ the term "aeropathy" as being more inclusive, and, for philological reasons, more widely available in all languages, and this term I shall employ hereafter in this paper.

Etiology. At the outset we will state our acceptance of the theory that gas emboli in the blood and body tissues are the direct cause of aeropathy symptoms, and a clear understanding of the etiology is essential to the correct interpretation of the Protean manifestations of this disease.

The animal experiments of Boyle, in 1670, laid the foundation for this theory, and its elaboration by Hoppe-Seyler, Bert, von Schrötter, Silberstern, Leonard Hill, and others has placed the gas emboli theory in an impregnable position.

Practically all autopsies if performed early upon victims of an acute attack of this disease show gas emboli in the veins and right heart.

All other theories may be dismissed at once upon the ground that none of them accounts for the formation of a single bubble of gas in the body fluids, an occurrence which we believe to be the one necessary factor in the etiology.

The fluids and tissues of a man working in compressed air become saturated with the gases of the atmosphere to a degree which depends upon (1) the amount of pressure (Dalton's law); (2) the length of exposure; (3) the vascularity and the absorptive ability of the individual tissue.

No symptoms ever develop while a man remains in the compressed air no matter what the degree of pressure nor length of exposure; hence we can state dogmatically that the disease is due solely to the ebullition of bubbles of ags (chiefly nitrogen) brought about by decompression, which is so rapid that the gases cannot be carried by the blood to the lungs and there gotten rid of gradually as they have entered; consequently they are set free as bubbles in the body tissues and fluids, with diastrous effects in many cases, forming emboli in the circulation or damaging tissues by the force of their expansion.

PHENOMENA OF COMPRESSION. Certain interesting phenomena are noted during the act of compression which are largely mechanical, and may be regarded as physiological; certainly they are in no sense symptoms of aeropathy.

1. The rising pressure forces inward the ear-drum membrane, causing discomfort, acute pain, or even rupturing this structure, unless the pressure be equalized by admitting air through the Eustachian tube, by Valsalva's method or an equivalent.

2. Slight rise in body temperature and sweating occur, due to the heat generated by the compression of the air.

3. The denser air offers a slight resistence to expiration and phonation. Whispering becomes impossible, and the lessened amplitude of vibration renders whistling difficult or impossible, and in such an attempt the non-vibrating lips give a sensation of slight numbness.

4. The voice loses its natural quality and sounds intensely nasal.

5. A sense of exhilaration and an ease of movement is experienced, and it is claimed that compressed-air work increases the appetite.

Other phenomena of compression have been reported, but are now generally discredited; thus,

Pallor of the skin and mucous membranes does not occur unless it be from nervousness on the part of the man entering compressed air for the first time.

There is no lessening of the volume of the pulse; no constant alteration in the blood pressure; no constant change in the rate either of the pulse or respirations.

The superficial veins do not collapse; the capillary circulation in a frog's foot continues unchanged. (Hill and others.)

There is no demonstrable change in the urinary or sweat excretion.

Hearing is not affected.

PHENOMENA OF DECOMPRESSION include chilling of the body, due to the falling temperature in the air lock, and one may at times note a crackling sound in the ears as the air escapes through the Eustachian tubes.

ONSET OF SYMPTOMS. The symptoms of aeropathy proper occur only as a result of decompression and after its completion.

The time of onset is from within fifteen minutes up to a few hours after decompression. Among the 3692 cases at the East River tunnels about 50 per cent. occurred within thirty minutes and 95 per cent. within three hours; however, 1 per cent. were delayed over six hours, and of these latter, four isolated and somewhat doubtful cases were said to have occurred between fifteen and twenty-three hours after decompression. (Keays.)

SYMPTOMS.—(1) *Pain* is by far the commonest symptom, occurring in over 88 per cent. of all cases, either as the only symptom or associated with others. Its most frequent (70 per cent.) site is in the lower extremities in the region of the knees, forcing the victim into an attitude which gives rise to the popular term "bends," or "courbatures." Next in frequency are pains in the upper extremities, about the elbows and shoulders in 30 per cent. Pains in the abdomen occurred in about 5 per cent. of the cases, but were of greater significance than were pains in the extremities in that they more often preceded or accompanied cases of severe prostration or paralysis.

2. *Vertigo*, or, in the parlance of the workers, "staggers," was met with in over 5 per cent., and is explainable by the formation of bubbles in the labyrinth of the internal ear, or when accompanied by nausea and vomiting it may be due to cerebellar gas embolism.

3. *Cerebrospinal cases*, including transient or permanent paralyses, such as hemiplegia, paraplegia, loss of bladder and rectal control, represented 2.16 per cent.

4. *Dyspnea*, called "chokes," of a type resembling an asthmatic attack, occurred in over 1.5 per cent., and may well be due to multiple small gas emboli in the pulmonary vessels; for were it of central nervous origin it would naturally be accompanied by other serious nerve disturbances, which is not the case.

5. *Prostration* of moderate degree associated with pains in some some part of the body made up 1.25 per cent.

6. *Collapse*, with partial or complete unconsciousness happened in about 0.46 per cent.

7. *Fatal cases* were 20 in number, or 0.54 per cent., and occurred either with rapid onset of unconsciousness and collapse; or with pains and protration, accompanied by nausea and vomiting; or with paralyses; or from later complications of persistent paraplegia.

CLASSIFICATION OF SYMPTOMS (Acute). The symptoms of aeropathy will vary with the anatomic part affected, with the amount of gas set free, and the consequent degree of disturbance of function.

Connective tissue, especially fat, with its peculiar ability of absorbing four times more nitrogen than other tissues, and its

poor blood supply, becomes desaturated more slowly than other body tissues; and it is found in practice that fat men are ill adapted to work in compressed air.

Proceeding therefore to tabulate symptoms with reference to the structures affected, we find symptoms referable to the following:

1. Nervous System. (*a*) *Peripheral Nerves.* Pain occurring in the extremities or abdomen in over 88 per cent. of all cases, without other evidence of spinal-cord irritation, except in a little over 2 per cent., must admittedly be due to peripheral irritation of nerves and nerve terminals by bubbles of gas in the nerve sheath, in fascial tissues, beneath the periosteum or in bone-marrow, etc.

Numbness, anesthesia, and paresthesia are doubtless capable of the same explanation.

One form of paresthesia, called by the workmen "itch," is quite common, is distressing while it lasts, but is never of serious import. This may be explained, as Hill does, as due to bubbles in the subcutaneous areolar tissue; but in my experience it is no more common in fat men than in thin men; it occurs especially when sweating has been less free, and it is usually at once relieved by a hot bath or sweating, all of which make it more probable that it is caused by expanding bubbles in the sweat glands.

(*b*) *Central Nervous System.* Brain: Unconsciousness, stupor, and collapse may be due to cerebral gas-embolism or the resulting edema, or are secondary to circulatory failure due to coronary or pulmonary embolism.

Cerebral gas-embolism may also cause temporary aphasia, incoherence of speech, ataxia, vomiting, vertigo, headache; or such signs as hemiplegia, monoplegia, convulsions, nystagmus, and tongue deviations, depending upon what area is affected.

Actual tearing of nerve tissue and hemorrhage may arise from the expansion of bubbles of gas, resulting in organic lesions.

Spinal Cord: Affections of the spinal cord include paraplegia, monoplegia, loss of bladder and rectal control, partial paralyses, spasticity, exaggerated, diminished, or absent reflexes; anesthesia, anesthesia dolorosa, etc.; and with hemorrhage into the cord the symptoms may become permanent and a true myelitis may develop.

Frequently, however, there is only a temporary weakness and numbness of the legs, with or without retention of urine.

2. Special Senses (*a*) *Eye.* Transient blindness, diplopia, and nystagmus may occur.

(*b*) *Ear.* Perforation of the drum membrane may occur, but only during compression, hence it is not properly a symptom of aeropathy. Deafness and vertigo may follow the formation of bubbles in the labyrinth or hemorrhage in the same situation.

3. Vascular System. Gas emboli in the veins of the systemic and portal system, in the right heart, in the pulmonary and coronary vessels, have been found so regularly in animal experimen-

tation and at autopsies upon fatal cases among men (provided the autopsy be performed within twenty hours after death from an acute attack) that this fact forms the whole basis of our understanding of the etiology of this disease. The bluish "mottling" of the skin, seen over the chest and abdomen in some of the more severe cases, is caused by embolism of the superficial veins, with consequent stasis.

Lymphatic obstruction by gas embolism is doubtless the explanation of the several instances of localized edema of a small area of an extremity.

4. Respiratory System. The symptom called "chokes" has been described above. In certain fatal cases there has been found edema of the lungs, also interstitial emphysema of the parenchyma.

5. Gastro-intestinal Symptoms, further than the epigastric pains and the nausea and vomiting above mentioned, are not encountered.

6. Internal Organs, such as the liver, spleen, kidneys, do not give any acute signs, although at autopsy they may be found affected.

7. The Sexual Apparatus is only affected as a result of spinal-cord injury, which may give rise to priapism, etc.

8. The Bones, Joints, and Periosteum. In one case necrosis of the femur resulted apparently from thrombosis of the medullary artery. The deep-seated pains so frequently referred to the long bones of the extremities and to the joints may be due either to collections of expanding bubbles under the fascial planes or under the periosteum; or, as Hill suggests, in the yellow marrow, which structure is rich in fat and deficient in circulation.

9. The Skin and Subcutaneous Tissues. The symptoms of "itch" and the "mottling" of the skin have been described above. Subcutaneous emphysema, without trauma, is met with in a few cases during life, and frequently in autopsies, especially along the course of the large veins of the extremities. Its presence as an accompaniment of contusions and punctured wounds I have several times demonstrated, and it is doubtless due to the setting free of gas from the extravasated blood; for it is hardly likely that such an amount of compressed air could enter through the puncture.

10. Localized Collections of Gas, aside from the small emboli scattered through the body, include the large collections found in the right side of the heart at autopsy (case sited below). At one autopsy which I witnessed there was a collection of about 5 c.c. of gas beneath the mucosa of the jejunum. In two other cases I succeeded in aspirating about 1 c.c. of gas from beneath the periosteum of the tibia; its presence was evidenced by a soft cushion-like swelling in this area.

11. Miscellany. In general wounds bleed as freely and heal as readily in the compressed air as in the normal atmosphere.

Infections of the middle ear and of the sinuses which communicate with the nose are favored by the efforts of men to force open the Eustachian tubes during compression, which factor also accounts for most of the infrequent cases of epistaxis in caisson work.

In the use of the diving helmet, however, bursting of the air tube may cause epistaxis, ecchymoses, ruptured eardrums, etc., by the cupping effect of sudden removal of pressure from the upper part of the body.

Cystitis, pyelonephritis, myelitis, and meningitis may occur as sequels of cord injury, but are not properly among the acute effects.

CONCLUSION. In a paper so limited little more than an outline of the acute effects of aeropathy is possible. In conclusion therefore I would report what is I believe the first analysis ever made of the gases found in the right heart of a man who died from the effects of this disease.

November 19, 1907, with the assistance of Dr. J. E. McWhorter, we collected 3.1 c.c. of gas by aspiration from the right heart at the autopsy, fourteen hours post mortem, of a man who died in one hour after a seventeen minute decompression, following eight hours' exposure to +30 pounds pressure. Upon analysis this gas yielded nitrogen 80 per cent., CO_2 20 per cent., which percentages are in accord with analyses made in animal experiments by various writers on this subject.

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THE LATE MANIFESTATIONS OF COMPRESSED-AIR DISEASE.[1]

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IN this paper attention is called to the ailments met in compressed-air workers years after the exposure and acute manifesta-

[1] This work was partly conducted under a grant from the Otho S. A. Sprague Memorial Institute. Read before the XVth International Congress of Hygiene and Demography in Washington, September 24, 1912.

tions. The material is practically the same as that which formed the basis of the article on compressed-air disease in the "Report of the Commission on Occupational Diseases of Illinois" (published in Chicago, 1911). An abstract of this report, read before the Chicago Neurological Society,[3] is as follows:

"Some of the men examined had had their acute attacks many years ago; others during the present year. Of the 161 men, 87 had various affections of the ears, causing permanent impairment of hearing in 65 cases; 141 gave a history of "bends," that is, severe muscular and articular pains; 34 had paralysis, most generally transient and affecting the legs, although 3 men have permanent partial paralysis of one arm and 3 of both legs; 11 present more or less chronic joint pain and stiffness. One of these men who developed an affection of the hip immediately after working his second shift in compressed air twelve years ago has been an invalid ever since, and presents the typical *x*-ray picture of arthritis deformans. He had been in perfect health before these two exposures to compressed air. One man with signs of caisson myelitis had a spontaneous fracture of the patella eleven years after the acute attack which had consisted of numbness in both lower extremities, followed by pain; 12 men now present signs of some degree of permanent cord disease; 13 were delirious or unconscious during the acute attack; 33 complained of vertigo as a prominent symptom; 6 of vomiting during the acute stage; 11 of incontinence or retention of urine; 5 had numbness without paralysis; 6 had "blind staggers," that is, labyrinthine vertigo, with nystagmus; 2 had "chokes." Several men gave a history of large swellings of the soft part of the chest wall or in the vicinity of joints. Bassoe had not seen them at this stage, but agrees with Heller, Mager, and Schrötter that the swellings are due to vasomotor disturbances of central origin, not to local liberation of gas (tumeurs gazeuses), as has been claimed by French writers. He considers the nitrogen-bubble theory of Paul Bert fully proved by both the observations on human beings and the abundant experimental work recorded in the literature. The cases treated by immediate "recompression" had fared much better than those not so treated."

Early in 1912 a number of these men were subjected to renewed and more thorough examination. They naturally group themselves in three classes, which will be taken up separately and illustrated by case records:

I. Cases in which spinal cord symptoms predominate: "caisson myelitis."

II. Cases of permanent joint affections, with the clinical and *x*-ray picture of arthritis deformans.

III. Cases of permanent ear affections.

[3] Jour. Nerv. and Ment. Dis., June, 1911.

Naturally some men present symptoms belonging in two or all three of these classes, but, as a rule, one set of symptoms predominates.

CLASS I. CASES OF "CAISSON MYELITIS."

Group A. *Cases with signs of trophic osteo-arthropathies dependent on the cord lesions.*

CASE I (Illinois report, Case 23).—Attack of "bends," with numbness of legs and stiffness of knees, in 1898; spontaneous fracture of patella in 1909; porosis and atrophy of fragments; fracture of external tuberosity of humerus in 1911. Signs of cord disease.

Male, aged forty years. Fourteen years ago he worked on Oak Street Water Tunnel, in eight-hour shifts. Pressure, twenty-eight to thirty-two pounds. After working for a week he had the first attack of "bends." Decompression three and a half to five minutes. Five and a half hours later was taken with numbness and cold feeling in both lower extremities from the hips down, followed by severe pain for six or eight hours and stiffness in the right knee. He returned to work in two days and then the knee felt better, but it has never been well since. In January, 1909, on getting up from a chair, the right patella was fractured and an abscess formed. He was laid up for five months. In August, 1909, he fell four feet and cut the skin over the right knee. On another occasion, on coming out from the lock, he had bleeding from the nose and ears. He returned to the lock and the trouble stopped. He has also worked on the Illinois Tunnel and the Four Mile Water Tunnel without trouble. He denies syphilis, but admits gonorrhea. He states that from the time of the acute attack of "bends" until the patella was fractured he had only slight pain.

Examination in October, 1910: Pupils normal. The right knee is stiff; there is a scar across it and there is palpable evidence of an old fracture of the patella. Ankle jerks absent; left knee jerk absent; right knee jerk cannot be tested on account of limitation of motion. On stroking the sole of the foot extensor response of the right big toe is obtained, and flexor response on the left side. Sensation normal. No sphincter disturbance.

Dr. Hollis E. Potter took an *x*-ray picture of the right knee and reports the following findings: "Fracture of the right patella at a point just below the middle of the bone. Diastasis of fragments of two inches. A third and smaller fragment lies between the two main portions. The lower fragment is elongated at the point of rupture. All surfaces of the fragments as now seen are rounded off, leaving no angles or corners. All fragments show porosis and bone atrophy."

In the spring of 1911 he fell on the floor on his left hand and sustained a fracture of the greater tuberosity of the humerus.

He admits rather heavy drinking, which probably accounts for an enlargement of the liver, which was quite marked when he was reëxamined in April, 1912. Then the right knee was found to be more freely movable, while there was slight limitation of motion at the right ankle. The knee and ankle jerks were now obtained on both sides, the former even exaggerated. The right knee jerk was stronger than the left, and the right-sided Babinski sign persisted. No ataxia. Sensation normal. Blood pressure equals 150 mm. of mercury. Urine normal.

CASE II (Illinois report, Case 59).—"Bends" in right knee in 1890; lame ever since; looseness of patella, with atrophy of bone; disturbances of reflexes and sensation.

(Cousin of Case I.) Male, aged forty-five years. Twenty years ago he worked on the Four Mile Tunnel at a pressure up to twenty-five pounds. He had several light attacks of "bends," and then, after he had been in the tunnel at a pressure of twenty-five pounds for about twenty-five minutes, he was taken with nosebleed, and five minutes later with bleeding from the left ear. He went out through the lock in one or two minutes, and on coming out bled from both ears. While still in the lock he had severe pain in the left temple and the left side of the forehead. After coming out the pain was less severe, but he was dizzy. Twenty-four hours later he was taken with severe pain in the right knee, which lasted for seven months. He was in the Cook County Hospital and two other hospitals on account of the pain, which later particularly involved the left knee and left arm. Twenty-seven months after the onset he went to work as an elevator man in the Cook County Hospital. He did this work for three months and gradually improved. Three years ago he tried to work in compressed air at Gary, Indiana. The pressure was seventeen pounds, and he only worked one shift, as he developed a peculiar sensation in the left arm.

He still limps, dragging the right leg. In the spring of every year he has more pain, and he then often has noticed that the right patella appears to be very loose. The left arm is numb in the region of the elbow. He has had no sphincter disturbance. He works most of the time, but can only do lighter work.

The watch-tick is heard at two inches in the left ear and at four inches in the right ear. Wrist jerks are absent, the elbow jerks diminished; abdominal reflex not obtained. The right cremasteric reflex is stronger than the left; the knee jerks are increased; the plantar reflexes are normal. The right ankle jerk is diminished; the left not obtainable. Tactile and pain sense are moderately diminished in both legs, especially on the outer surfaces. The right lower extremity is two inches shorter than the left, and the circumference of the right thigh is two inches less than that of the left, while the circumference of the right calf is only one-half inch

less than that on the left side. The right patella is slightly more movable than the left.

On account of the looseness of the right patella the patient was referred to Dr. Hollis E. Potter for *x*-ray examination of the right knee. Dr. Potter's report is as follows: "The noticeable feature is a lateral widening of the upper face of the tibia, allowing a projection of one-half inch of this bone beyond the articular surface of the femur. It is difficult to account for this, since all profiles of both bones are smooth and regular, excepting a slight roughening of the inner condyle of the femur on its articular surface, suggesting cartilaginous loss. Slight atrophy of patellar borders."

Many years ago he injured the right eye in a dynamite blast, and the right pupil has been dilated ever since. Formerly the pupils were equal and the eyes normal in every way, according to the patient's statement.

CASE III (Illinois report, Case 37).—Repeated attacks of "bends" for twenty-seven years; paralysis and incontinence in 1910; signs of cord disease; islands of atrophy and of sclerosis in tibia.

Male, aged forty-six years. He has worked in compressed air in various places since seventeen years of age. Had "bends" lightly in New York and New Jersey, worse in Cleveland, where the pressure was forty-eight pounds, and where he worked in two-hour shifts, at intervals of four hours. After exit in four minutes he was taken with severe pain in the legs and arms and was in a hospital for four weeks. He could not stand high pressure well afterward; developed the "bends" again, and left Cleveland. When working on the Four Mile Tunnel in Chicago, at a pressure of twenty-seven to thirty pounds, he had slight "bends" after coming out through the lock in about three minutes, and he had to abstain from working for three days on account of the pain. In 1910 he worked at Hibbing, Minnesota, where an ore shaft was sunk. Pressure, thirty-eight to forty pounds. After his first shift of two hours on January 20, he came out through the lock in about one and a half minutes, although the posted order of the company was that the time should not be less than fifteen minutes. But there was a "green" lock-tender. Immediately after exit he had severe pain in the abdomen and extremities, could not walk, and at the same time the left ear-drum was ruptured, with bleeding from the ears. He was placed in the hospital lock, without relief; then he had a hot bath, and was placed in the hospital lock a second time. He was in the hospital for three weeks, and then stayed five weeks at the hotel, unable to work. He could not walk for seven weeks after the onset, and had incontinence of urine and feces until a few months before being seen in October, 1910. At that time urination and defecation were still precipitate, and he still had some weakness and pain in the legs. He could not hear watch-tick when the watch was in contact with the left ear; barely heard it in the right ear.

Knee jerks were normal or slightly exaggerated. Right ankle jerk was absent (left not tested). He did not feel pinpricks in the legs and hands. He said that when examined at the hospital at Hibbing he could not feel pinpricks.

When seen again, in April, 1912, he had not been in compressed air since the previous examination. He had worked some, but was troubled with pain in the right leg and occasional incontinence of urine and feces; of the former, especially after drinking beer. The right leg sometimes "gave way" when he walked, but recovered after a brief rest. The right ankle was considerably stiffened, while there was normal range of motion in the other joints. There is now distinct analgesia only of the outer part of the left foot, and the outer aspect of the lower third of the left leg. No Romberg sign. Blood pressure equals 100 mm. of mercury.

X-ray examination by Dr. Hollis E. Potter fails to show any bony change to account for the stiffness of the right ankle. There is no change in the tibia within an inch of the ankle-joint, but from this level and extending upward there are irregularly shaped islands of atrophy and of sclerosis in the interior of the bone. There is also mushrooming of the anterior portion of the astragalus into the scaphoid, resulting in flat-foot.

Group B. *Very Limited Persistent Cord Lesions.*

CASE IV (Illinois report, Case 110).—Two attacks in 1896; permanent sensory loss in left ring and little fingers.

Male, aged fifty-two years. About 1896 he worked for six months in compressed air at the Sixty-eighth Street Tunnel in Chicago. He had two attacks. The first one occurred after coming out from a pressure of twenty pounds. He had severe bursting sensation in the head, nosebleed, ringing in the ears, and dizziness. On returning to compressed air he was considerably relieved, but on coming out the second time the ring and little fingers of the left hand became numb. He could move them, but they were evidently analgesic, as four months later a piece of flesh was accidentally torn out of the little finger without causing him any pain. The right heel also became numb in this attack, and remained so for about six months. He stayed away from work one week. The second attack occurred a month later, and consisted of similar sensations in the head. He again improved on returning to compressed air. The condition of the affected fingers and heel was not changed by this attack. He lost two shifts. A few years later he worked on the Oak Street Tunnel, and had no trouble except that he was "blocked" a few times. He quit compressed-air work and now works at a pumping station.

Examination in 1910 revealed diminished tactile, pain, and temperature sense of the left ring and little fingers, and of the ulnar side of the hand and forearm, more so on the extensor surface. The wrist, elbow, knee, and ankle jerks were normal. The watch-

tick was heard at eight inches on the left side, twelve inches on the right side, and he is now in good health.

When reëxamined in June, 1912, he still complained of "sleepy feeling" in the same fingers and in the ulnar portion of the hand. The anesthesia remained, and there was also loss of the sense of passive motion in the affected fingers.

CASE V (Illinois report, Case 107).—Attack of pain in right hand and forearm in 1898; persistent analgesic area on forearm.

Male, aged thirty-nine years. In 1898 he worked on the Sixty-eighth Street Tunnel, Chicago, and after working three months he had an attack while at work, at a pressure of eighteen to twenty-four pounds. He was taken with pain in the fingers of the right hand, which ascended to the elbow, and was very severe. He went out through the lock in three or four minutes, which was unusually slow, and then became dizzy and had ringing in the ears. The pain remained about the same and lasted for five weeks. He went to work after ten weeks, but not in compressed air until working on the Thirty-ninth Street Tunnel about three years later. The pressure here generally was twelve pounds, and he had no trouble.

The right arm has been a little weak ever since the attack, and occasionally there is a "stitching" pain in it after a hard day's work. On examination the arm reflexes and tactile sensation in the arm are normal, but there is an analgesic area in the inner half of the upper third of the anterior surface of the right forearm. Knee and ankle jerks increased without clonus. Watch-tick heard at four inches in the left ear, ten inches in the right ear.

When seen again in March, 1912, he said he had been forced to give up his work as a bricklayer's tender because heavy lifting would cause pain and subsequent "falling asleep" of the right arm from the elbow down.

Three other cases of this kind will be placed in Class III on account of the more important joint lesion (Cases XII, XIII, XV).

Group C. *Cases of Ordinary More or Less Extensive "Caisson Myelitis."*

CASE VI (Illinois report, Case 8).—Onset in 1890; persistent pain in the legs and precipitate micturition; changes in the reflexes.

Male, aged fifty-four years. First seen in July, 1910. He worked under compressed air on the Four Mile Tunnel, Chicago, from 1890 to 1893, and had charge of the bricklaying. He had the "bends" three times. The first time after an eight-hour shift he came out from a pressure of twenty-two pounds in two or three minutes, although he had been advised by the engineer in charge to spend ten minutes; but this precaution was seldom taken. In half an hour he was taken with severe pain in the knees, shoulders, and wrists, became dizzy, fell down in the street, and was picked up by a policeman, who thought he was drunk, until informed to the

contrary by other workmen. He returned to work the next day. The second attack was similar, starting with pain in the knees, then he was dizzy and slightly dazed. He returned to work the next day. The third attack came on one-half hour after less than five minutes' decompression after an eight-hour shift in pressure of thirty-three to thirty-five pounds. He was attacked with dizziness and pain in the knees. Was taken home, stayed in bed for about thirty-six hours, was not clear mentally, sat up in bed, and "mumbled." He returned to work in a week, but the legs were weak and aching and the back was painful on stooping. There was no sphincter disturbance at first, but in a few weeks he developed precipitate urination, which grew worse and became permanent. He had to give up work, and was a patient in the Cook County Hospital from February to May, 1895. His case then seemed to have attracted considerable attention. He has never recovered, has suffered much pain, and walks very poorly. Has not been able to work at his trade since then, and has been idle most of the time; but at the time of examination had an easy position as night watchman. He was in perfect health before working in compressed air, but has been a heavy drinker. On examination there is found opacity of the left cornea. The right pupil reacts to light. Hearing in the right ear is defective, the watch-tick only being heard on contact. In the left ear it is heard at three inches. He cannot get the right heel down to the floor except when the left heel is raised. The left knee jerk is considerably exaggerated, but the right is about normal. Both ankle jerks are diminished, the left more so. Arm reflexes normal. Sensation normal. He died suddenly in 1911.

CASE VII (Illinois report, Case 155).—Four attacks of "bends," one associated with transient paralysis of both legs and retention of urine. Increased reflexes and sensory disturbance.

Male, aged twenty-four years, was seen in November, 1910, at St. Louis, where he was working in caissons for the new bridge. He had worked in compressed air since 1903. The first attack was in 1907, and came on after working at a pressure of twenty-two pounds. The decompression lasted seven minutes, and ten minutes later he was taken with severe pain in the left knee. He was well in two days and had the second attack six months later, after coming out from a pressure of twenty-eight pounds in ten minutes. He had pain across the abdomen, and "knots" formed in the abdominal muscles. Both legs were paralyzed for two hours and he had to be catheterized for two weeks. For the next six months there was some dribbling of urine, and since that time the legs "fall asleep" easily. He returned to work in a month and worked two three-hour shifts at a pressure of thirty pounds in one day. After coming out from the second half in ten or twelve minutes he was immediately taken with pain in the abdomen.

He took a bath and was then suddenly attacked with extreme dizziness, tinnitus, and nausea. He could not see plainly; everything seemed to whirl around. He did not vomit until a physician gave him medicine, which he thinks was an emetic. He was in the hospital for ten days; could walk after four days, but some dizziness remained for two months. Tinnitus and complete deafness were present the first three days, and hearing has never been normal since. Then he had a couple of attacks of "bends" while working on two bridges in Arkansas. The first one was slight and affected the hips; the second one was rather severe, affected the left arm, and he did not fully recover for a week. Since February, 1910, he worked on the bridge at St. Louis, and in April, while working two daily two-hour shifts at a pressure of forty pounds, he had an attack. Decompression lasted fifteen minutes, following which he was taken with pain in the left hip, which lasted all night, and finally, was relieved in the hospital lock, but he had to go in and out four times. Aside from these definite attacks he has frequently had some burning in the skin of the abdomen and of the left arm after coming out. This has occurred as a regular thing when the pressure was high. He has also frequently been dizzy for about ten minutes after coming out.

Watch-tick heard in right ear at three feet; in the left ear not heard on contact, but C–2 tuning-fork is heard. Both knee and ankle jerks are exaggerated, and there is reduced pain sensation in the left leg.

In this connection the following case is of interest as showing how repeated attacks with severe acute symptoms may fail to produce any permanent disease:

Case VIII (Illinois report, Case 147).

Male, aged thirty-six years; foreman. Seen at St. Louis in November, 1910, where the following record was made: Has worked in compressed air for ten years, much of the time as foreman or superintendent; has made his own rules, and has stayed much longer in and come out more quickly from the compressed air than the ordinary laborers are permitted to do.

The first attack occurred at Canadian, Texas, in 1905. He stayed in a caisson, which had sunk, for one and a half hours at a pressure of fifty-three pounds, and came out in about five minutes. Then stood out in the cold air for a while, and after fifteen minutes suddenly became paralyzed from the waist down. He had no pain, could not move the legs for eight days, had to be catheterized for ten days, and required enemas to move the bowels. He then improved rapidly, but had severe pain in the knees and ankles for four days after recovering from the paralysis. He had full control of the bladder after the retention ceased, but there was burning on micturition for some time. The catheter had not been boiled, and had been passed by a "sand-hog." The next attack

occurred in Arkansas one year ago, after he had spent twelve consecutive hours in a pressure of forty pounds. He came out as rapidly as the valve would permit, and had severe pain in the right shoulder for two days. He had no trouble when working on the Traction Bridge at St. Louis, but has had two attacks while working on the new bridge since last February. The first one occurred on the Illinois side last September. He spent seven hours at a pressure of fifty-one and one-half pounds, and came out in three and one-half minutes, while the time prescribed for the men was thirty-five to forty minutes. Five hours later, when in bed, he was taken with slight pain in the knees, and one hour afterward became paralyzed from the waist down. He was placed in the hospital lock forty-five minutes after the onset of paralysis, and movement returned in thirty-five minutes. He stayed in the hospital lock for about eighteen hours, and then was well and returned to work. The second attack also occurred on the Illinois side, on October 25. He stayed in a pressure of forty-five pounds for several hours, came out in three to five minutes, and half an hour later was taken with pain in the right shoulder. He used hot applications without any benefit, and two hours later he went to the hospital lock, where he remained for seventeen hours, during which he had no relief at all, and after coming out he was worse than before. The arm is still weak and hurts a little. There was no swelling. Reflexes and sensation in both arms normal. Knee jerks brisk.

CLASS II. CASES OF PERMANENT JOINT DISEASE OF THE TYPE OF ARTHRITIS DEFORMANS.

In the course of this investigation several cases were observed in which chronic arthritis of one or more joints had developed as a sequel of "bends" in the vicinity of the joints affected. The histories are so explicit on the point of the origin of the joint trouble in attacks of articular pain immediately following exposure to compressed air that it seems an etiological relationship must exist. In some of the cases (XII, XIII, XV) acute cord symptoms as well as persistent ones were present, so as to make it possible that we are dealing with the osteoarthropathies previously considered, while in others it seems simpler and more reasonable to assume that the joint changes are the result of trauma to the articular structures by the local liberation of air—a well-recognized and common phenomenon.

CASE IX (Illinois report, Case 47).—Typical arthritis deformans of right hip; onset in 1899 after working only two shifts.

Male, aged sixty-nine years; carpenter. Twenty years ago he worked on the Four Mile Tunnel in Chicago without trouble. Eleven years ago he did some carpenter work in the Oak Street Tunnel and worked two eight-hour shifts under a pressure of about thirty pounds, from which he came out rapidly. On the way home

from the last one he was taken with pains in the legs, which became extremely severe and lasted all night. He says that he was blue all over the body and the physician could not feel his pulse. The blueness disappeared after rubbing the skin. He went to work in four days, but the legs were weak, especially the right one. He has walked lame ever since on account of pain, which is chiefly felt in the right groin, and especially comes on when he starts walking. A year after the onset he saw the late Dr. Christian Fenger, who put on an extension apparatus for ten weeks. Then he felt worse and had to use crutches for a year. He has not worked since this time. He never had any rheumatism, and was in good health before this occurrence. The knee jerks are brisk and the ankle jerks normal. Sensation and plantar reflex in the right leg normal. He had no sphincter disturbance, but now has to get up at night to urinate. There is an apparent lengthening of the right leg, which he says has been present ever since the extension apparatus was used.

Dr. Hollis E. Potter took an *x*-ray picture of the right hip and reports the findings as follows: "All changes are compatible with an arthritis deformans of the hip-joint, namely: The head of the femur is flattened and mushroomed; the neck of the femur appears shorter and wider; cartilaginous space decreased; osteophytes laid down at edges of cartilage, acetabulum, and head of femur."

The above notes were made in October, 1910. When last seen in May, 1912, the condition of the hip remained the same. The distance from the anterior superior spine to the inner malleolus was the same on both sides, but that from the umbilicus to the inner malleolus was 1.5 cm. greater on the right side. There was limitation of motion in the right hip in all directions.

CASE X (Illinois report, Case 115).—Attack of "bends" in 1901, at once followed by pain in the right knee and a couple of years later by pain and stiffness of the right hip. Typical advanced arthritis deformans of the latter.

Male, aged forty-eight years. In 1901 he worked on the Thirty-ninth Street Tunnel without trouble. Then in Cincinnati for three months in 1902. His first shift was six hours at a pressure of fifty pounds. He came out through two locks, spending five minutes altogether. One and a half hours later he was taken with severe pain in the right knee, chiefly located at the inside of the patella. It was severe for three days. Neither hospital lock nor a bath-tub was available. He has had more or less pain in the right knee ever since. He became unable to bend the knee fully, and could only walk a few blocks. He worked as a bricklayer until 1905, and since then has been a masonry inspector for the city. He has been in compressed air occasionally, but has had no further attack. Two or three years after the acute attack he also developed pain

in the right hip, and this joint gradually became stiff. He has been considerably better during the last one and a half years, and ascribed the improvement to massage. Examination revealed marked limitation of motion in the right hip. The knee and ankle jerks are exaggerated, slightly more so on the right side. Sensation in the lower extremity is normal, but he complains of occasional sensation of pins and needles in the soles of the feet, and sometimes the fingers become white and feel a little numb. When standing long the pain in the hip and knee gets worse, and the thigh feels numb. *X*-ray picture of the hip taken by Dr. Max Reichmann in 1912 shows the joint partly obliterated by bony hypertrophy along the acetabular margin and at the base of the head of the femur. There is plastic overgrowth of bone at the upper margin of the neck. There is slight upward wandering of the acetabulum compatible with shortening of one-half inch. The condition is typical of advanced arthritis deformans of the hypertrophic type secondary to an atrophic state.

Case XI (Illinois report, Case 72).—Attacks of bends and vertigo in 1905; since then repeated joint swellings; *x*-ray findings typical of arthritis deformans in knees and ankles; areas of atrophy and sclerosis of bone in right fibula.

Male, aged forty-one years. In 1905 he worked for nearly a year as timekeeper at the East Boston Tunnel. Pressure variable; maximum, twenty-six pounds. After working ten weeks he had his first attack after coming out from a four-hour shift at a pressure of twenty-six pounds in eight or ten minutes. Immediately after exit he was taken with dizziness, bleeding from nose, ears, and eyes, pain in the knees and ankles, and across the small of the back. He was taken home in a carriage and stayed in bed for four weeks, during which the pain was continuous and severe, especially in the back. He could move the legs, but could not get up on account of the pain. Urination was slow, followed by dribbling, and has remained so. Sexual power not affected. Some dizziness and tinnitus, especially on right side, have persisted. He returned to work in six weeks, but could do very little. Two weeks later, after coming out in ten or twelve minutes from a pressure of twenty-four pounds, he was again taken with dizziness, nosebleed, and pain in the knees and back. Stayed in bed three weeks. After another week he went to work, but never returned to compressed air, and has worked as a salesman and insurance agent. He has become generally nervous, suffers considerably from pain in the back and knees, headache, and tinnitus, the latter particularly during colds. Occasionally there is swelling of the knees and ankles, all of which joints became swollen within a few hours after exit from the lock at the time of the attack. These joints now become swollen about once a month, usually all four at a time, and the swelling lasts from a few days to two weeks.

The watch-tick is heard in the right ear at six inches, left ear at twelve inches. Knee and ankle jerks normal. There is much tenderness about the knees and a grating is felt when the patellæ are moved.

When last seen, June, 1912, he stated that he had been in bed for a month during the winter on account of pain and swelling of the knees, ankles, and hands. Grating in the knees, especially the right one, was still present.

X-ray pictures of the right knee, as interpreted by Dr. Hollis E. Potter, show deposition of bone at the upper anterior surface of the patella, "lipping" of the tibia anteriorly, and external displacement of the tibia on the femur, the joint surfaces not being in perfect apposition. The right ankle shows fragments of bone at the extreme lower end of the fibula, but it is not clear whether they are derived from the fibula, astragalus, or ossified ligaments. The lower half inch of the fibula shows irregular areas of atrophy and sclerosis. The left ankle shows little change, merely slight atrophy of the extreme tip and inner surface of the fibula adjacent to the astragalus. The hands show no changes.

Case XII (Illinois report, Case 111).—Attack of "bends" in 1896, both shoulders affected; now pain and stiffness of left shoulder; anesthesia over left scapula; *x*-rays show arthritis deformans of left shoulder.

Male, aged forty-three years. First seen in October, 1910. About twenty years ago worked as a bricklayer on the Four Mile Tunnel, Chicago. Pressure eighteen to twenty-one pounds. He worked seven and a half hours a day at one stretch. One attack occurred after coming out in three to three and a half minutes. He first had twitching in the muscles of both arms, and half an hour later severe pain in the same locality, which lasted for about eight hours. The next attack occurred in 1896, after he had been working for two weeks on the Cleveland Tunnel. He came out in about two and a half minutes from a pressure of thirty-four pounds, in which he had worked continuously for nine hours. At once he was taken with severe pain in the chest and both shoulders. He went back in the lock for two hours, during which he was relieved, but after coming out the second time in four or five minutes the pain returned. Then he was again relieved by staying in a warm bath for six hours, but the pain returned and lasted about four days. He then returned to work and had no pain while in compressed air, but ever since this attack he has frequently had twitchings and pain about both shoulders and across the chest, when not in compressed air. The trouble is now diminishing, and he only has it occasionally, when resting after a hard day's work. It is now only felt in the left shoulder. He is now a sewer inspector. He had no rheumatism of any kind before this attack. He denies syphilis, but admits gonorrhea. Examination revealed consider-

able limitation of movement in the left shoulder. He cannot raise the arm fully to the vertical position. The arm reflexes are normal. There is a triangular area of tactile anesthesia above the spine of the left scapula. The temperature sense is also diminished in this area and downward to the level of the angle of the scapula. Pain sense is lost in the triangular area, but is not affected as far downward as is the temperature sense. Sensation on the arm and chest normal.

When reëxamined in 1912 the findings were practically the same, the anesthetic area extending from the edge of the trapezius nearly to the angle of the scapula.

X-ray examination of the shoulder by Dr. Max Reichmann shows the head of the humerus to be enlarged and porotic. There is great irregularity in the joint surfaces, and the rim of the glenoid cavity is greatly overgrown with bone.

CASE XIII (Illinois report, Case 5).—Pain in legs and paralysis in 1897. Limitation of motion in hips. Articular pains since onset. Altered reflexes.

Male, aged forty-eight years; bricklayer. In 1897 he worked in compressed air during the construction of a water tunnel at Rockford, Illinois. The pressure was thirty-nine pounds, and he worked in two long periods. He thinks decompression lasted about five minutes, as only a one and one-half inch valve was used. After coming out from his third shift he was immediately taken with pain in the legs, walked to his boarding house, became paralyzed in the legs, and was taken to a hospital in Rockford, where he remained for three days, during which there was much pain. He was then taken back to Chicago, but could not walk at all for six months. During this time he could move the legs a little, but every movement caused pain and the muscles often felt "as if tied in a knot." There was no sphincter disturbance at first, but about a year and a half later micturition was slow and rather painful for a time. He has never been entirely free from pain since the acute attack, and had to give up bricklaying altogether. The pain affects the knees, thighs, and hips, and is generally worse in the autumn of every year. He has done a little work as inspector for the city and some light work in tunnels, but recently he has been quite lame and unable to do any work. Of late he has had considerable edema of the legs.

The pupils are equal and react normally. The knee jerks are slightly increased. The ankle jerks cannot be obtained, while the wrist and elbow jerks are increased. Abdominal and cremaster reflexes normal. Sensation normal. Considerable stiffness, pain, and limitation of movement in both hips. The strength in the muscles of the legs is fair. Heart normal. The urine contains considerable albumin.

CASE XIV (Illinois report, Case 58).—In 1899 attack of pain in legs, vertigo; rupture of ear drum and persistent deafness; left knee still painful.

Male, aged forty-three years. Seen in October, 1910. He first worked under a pressure of nine to fifteen pounds on the Illinois Tunnel in 1899. On one occasion, when the pressure was nineteen pounds, he had a bursting sensation in the ears while in the lock, and had bleeding from both ears, nose, mouth, and eyes. He became extremely dizzy and partly unconscious; was carried out and taken to the Polyclinic Hospital, where he stayed for three days, during which time he was very dizzy. The left drum was found to be ruptured; the bleeding lasted for about an hour and a half, when there was purulent discharge from the left ear for six or seven months. He also had pain in the limbs and back, and had to be helped to raise himself in bed. He had much backache for four months, and there was left tinnitus, like the ringing of bells, for two years. Hearing in the left ear has been lost ever since. Three years ago he worked in compressed air at Clinton, Iowa, but he had to give it up on account of dizziness and queer feeling in the head. Both knees, especially the left, have been quite stiff ever since his first attack. He had then returned to work in six months, shoveling earth, but had to quit in less than a week on account of pain in the knees, arms, and back. The left knee now is painful on passive movement and on tapping the patella. The knee jerks are normal. The left ear is totally deaf, not even a C–2 tuning-fork is heard. Watch-tick heard in right ear at one foot.

CASE XV (Illinois report, Case 160).—Ear trouble since "blocked" in 1898; three attacks of "bends" in 1901; still often pain in knees and ankles; *x*-ray of left knee shows islands of sclerosis in tibia and thickening of surface of tibia; diminished sensation and decreased reflexes in legs.

Male, aged thirty-five years. First seen in October, 1910. In 1898 he worked on Illinois Tunnel, under a pressure of eighteen pounds. Bled from right ear when going through lock the first time. He returned to work the next day, but had tinnitus for a week, and the right ear has been slightly deaf ever since. Whenever he had a cold this ear would trouble him when he went into compressed air. In 1901 he worked for one year in Cleveland, Ohio, Water Tunnel, where he had three attacks. The first one occurred after he had been working for three weeks. One hour after very rapid decompression following an eight-hour shift at thirty-seven pounds he was taken with pain in both legs, "like a sword tearing up and down the flesh," which lasted eighteen hours. He was out of his head on account of the pain—"would have killed himself if he had the chance." He was given plenty of hot whisky, and returned to work in five days. Two other men were affected at the same time. The second attack occurred three

weeks later, after quick decompression following an eight-hour shift at twenty-seven pounds. He returned to the lock on account of severe pains similar to those of the first attack, and improved rapidly. Went out again slowly and was able to return to work the next day. Four weeks later he had the third attack, which came on less than one hour after coming out rapidly from a pressure of twenty-seven pounds. He had to go to a cold room, although according to the rules, a warm one should have been provided. He had pain like that of the previous attacks.

In 1907 he worked for three months at Clinton, Iowa. In the course of the work the pressure was gradually raised to twenty-seven pounds. After coming out from a four-hour shift with wet feet, on account of leaking boots, he was taken in three-quarters of an hour with the same kind of pain as before. He returned to the lock, remained one hour, came out slowly, and was well. He did not return to work there, but in 1909 he worked on the Northwestern Depot, Chicago, under a pressure of about eighteen pounds. He was "blocked" a few times, but had no other trouble.

He now works in open caissons and is in good health, with the exception that the legs are often stiff in damp weather. He never had this trouble before the attack of "bends."

Watch-tick heard at one and one-half inches in the right ear; four inches in the left.

When seen again, June, 1912, he still complained of pain in the knees and ankles in changeable weather, "in the same place where he had the bends." The knee and ankle jerks were sluggish, and both tactile and pain sense seemed to be reduced from the knees down. The patient has seven children, and denies venereal disease.

Dr. Hollis E. Potter made an *x*-ray examination of the knees. Two inches below the left knee-joint there are changes in the spongy tissue of the tibia in the shape of irregularly branching or stellate islands of sclerosis. Dr. Potter is of the opinion that this appearance is caused by a reconstruction of the bone following an atrophic process. There is also a bulging thickening in the surface of the tibia just below the head of the fibula. The right knee shows no change.

CLASS III. EAR AFFECTIONS.

As stated, 87 of the 161 men gave a history of ear affections, and 65 have more or less impairment of hearing; 33 complained of dizziness. Rupture of the drum, which, according to the large experience of Koch[3] and of Chrabrostin,[4] is rare, was said to have occurred in our Cases III and XIV, related elsewhere in this paper, and in one other case. However, we only have the patient's state-

[3] Festschr. Friedr. Wilhelmsinst, Berlin, 1895.

[4] Official Report on Work under Water to Russian Navy Department, 1882. Cited after Heller, Mager, and Schrötter: Die Luftdruckerkrankungen.

ment that they were so informed by some doctor, who might have drawn the erroneous conclusion that hemorrhage from the meatus indicated rupture of the drum. Such hemorrhage had taken place in a large number of cases.

Eight of the men with more or less marked permanent deafness were referred to Dr. G. W. Boot for otological examination. In every one a diagnosis of labyrinthine deafness was arrived at. In five of these men marked nasal obstruction was present, caused by deflected septum or enlarged turbinates, which furnishes a reason for the liability of these men to be "blocked" on entering the caissons. Four of them state distinctly that the ear symptoms came on after decompression, which harmonizes with the labyrinthine character of the deafness. However, according to Heller, Mager, and Schrötter,[5] the general experience has been that "decompression is of no importance in caisson workers when the ears are healthy." The presence of nasal obstruction in so many of our men therefore becomes significant, as the ears may have been diseased beforehand, and as such obstruction would render equalization of pressure by means of free passage of air through the Eustachian tubes extremely difficult.

CASE XVI.—Eighteen years ago partly "blocked" on entrance; after decompression pain in ear, vomiting, vertigo, total deafness for a time; persistent tinnitus and partial deafness.

Male, aged thirty-six years. In 1894 he was partly "blocked" on entering a pressure of twenty-seven pounds. Two and a half hours after coming out he was taken with pain in the left ear, vomiting, vertigo, and delirium. He was delirious for several days, during which there was considerable bleeding from the left ear, and later discharge of pus. There was total deafness at first, but soon hearing was partly restored. He has never been in compressed air since then. Left-sided tinnitus has persisted, and he often feels dizzy. Dr. Boot examined him in June, 1912, and reports:

"Whisper in right ear heard at 30 cm.; in left ear loud whisper only heard close to the ear. Bone conduction much shortened. Weber to the left. Low limit: Hears 32 with each ear. C–4 shortened in the left ear. Upper limit: R., 20,000; L., 19,000. Throat normal. Nasal septum deflected to the right. Right tympanic membrane lusterless, position normal. Left retracted, luster good. Irrigation of the right ear with cold water gives rotary and horizontal nystagmus to the left. Irrigation of the left ear with cold water gives rotary and horizontal nystagmus to the right, chiefly rotary. Hearing improved by inflation. Diagnosis: Tubal occlusion; labyrinthine deafness."

No further discussion of the ear findings in these cases will be given here, as Dr. Boot will publish a separate article on this subject in the near future.

[5] Loc. cit., p. 1003.

PERSISTENT DUCTUS BOTALLI AND ITS DIAGNOSIS BY THE ORTHODIAGRAPH.

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THE diagnosis of congenital cardiac disease is so notoriously uncertain that any aid to its accurate accomplishment is worthy of careful study. This is especially true of the lesion which forms the subject of this paper—patent ductus arteriosus—in view of the fact that clinicians for many years have doubted the possibility of its certain diagnosis *intra vitam*. For this feeling there was ample justification until the study of this condition by the *x*-rays, and especially by the fluoroscope, revealed a pathognomonic change in the configuration of the heart which made it possible to diagnosticate it with reasonable certainty. To understand the significance of this discovery, it is necessary to rehearse briefly the appearance of the normal heart silhouette as revealed by the fluoroscope.

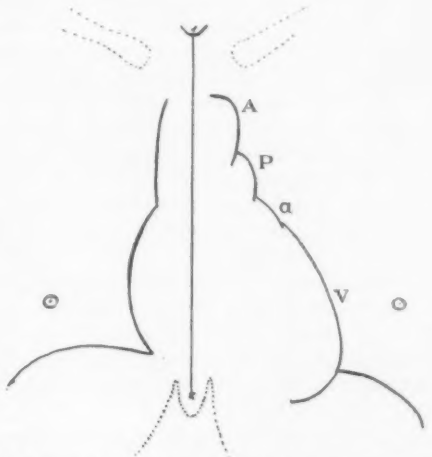

FIG. 1.—Orthodiagram of normal heart, reduced. *A*, aorta, *P*, pulmonary artery; *a*, left auricle; *V*, left ventricle.

The left side of the heart shadow normally appears as a broken convex curve composed of four elements, as follows (Fig. 1): Beginning from above one sees a large curve due to the arch of

the aorta (*A*); below this and somewhat smaller appears the curve of the pulmonary artery (*P*); below this and but faintly indicated is the left auricular appendage (*a*); and finally is seen the large curve of the left ventricle (*V*). Each of these pulsates, the excursions having different amplitudes. The aorta shows an excursion of moderate extent, the pulmonary artery one of less extent, the auricular appendix usually appears immobile, and finally the larger, wider pulsation of the left ventricle is apparent.

In patent ductus arteriosus the appearance of the heart above described is modified in the following manner: The middle area of the left border of the heart shadow is much enlarged, so that in extreme cases a ball-like prominence here surmounts the heart. The position and pulsation phase of this shadow show it to be that of the pulmonary artery. Moreover, whereas the normal pulmonary artery beats but slightly, and with less vigor than the aorta, in cases of persistent ductus Botalli the pulmonary artery pulsates more powerfully than its neighbor. On watching this shadow one gains the impression that with each systole the pulmonary artery is actively distended by an increased volume of blood.

This observation was made fifteen years ago by Zinn,[1] and has since been verified by De la Camp,[2] Hochsinger,[3] Bittorf,[4] and others, and recently by Groedel, who has used the orthodiagraph for the diagnosis of the condition. This enlargement of the pulmonary artery is logically explained by the influx of blood into it from two sources: the right ventricle and the ductus arteriosus, leading to its dilatation. The fluoroscopic appearance is correlated with the band of dulness along the left border of the sternum in the three upper interspaces first described by Gerhardt[5] in 1876, and since then known as Gerhardt's sign. The value to the clinician of this fluoroscopic appearance is heightened when one interrogates the opinions of those who have studied this defect, and realizes how varying are the physical signs which have been pointed out as characteristic of this condition.

Vierort[6] has formulated the physical signs of patent ductus arteriosus as follows: A murmur which is usually systolic is heard over the pulmonary area; hypertrophy of the right side of the heart; accentuated second pulmonic sound.

Gibson[7] may be quoted in his own words as follows: "The

[1] Zur Diagnose der Persistenz des Ductus a. Botalli, Berl. klin. Woch., 1898, No. 20. p. 433.

[2] Congenitale Herzleiden, Die Deutsche Klinik am Eingnang des XX Jahrhunderts, p. 198, et seq.; also Berl. klin. Woch., 1903, No. 3, p. 48.

[3] Zur Diagnose der Persistenz des Botallischen Ganges und der Erweiterung der Lungenarterie, Wiener Klinik, 1907, p. 311 to 348.

[4] Ein Fall von offenem Ductus Botalli, Münch. med. Woch., 1903, No. 41.

[5] Persistenz des Ductus arteriosus Botalli, Jena Zeitsch., 1876, iii, No. 2.

[6] Nothnagel's System.

[7] Persistence of the Arterial Duct and its Diagnosis, Edinburgh Med. Jour., 1900, viii, 1.

diagnosis of patent ductus arteriosus may be founded with perfect confidence. The recognition of the lesion may depend on the presence of a few physical signs. . . Palpation usually reveals a long thrill following the apical impulse and enduring beyond the recoil of the blood on the semilunar cusps, which may be felt during the thrill; percussion may not show any enlargement of the cardiac dulness, while auscultation gives convincing proof of the lesion in a murmur which may be regarded as almost pathognomonic. Beginning directly after the first sound it accompanies the latter part of that sound, occupies the short pause, accompanies the second sound, may be and often is doubled, and finally dies away during the long pause."

Hochsinger,[8] who has perhaps studied this subject most intensively, has endeavored to unravel its diagnosis in the presence of associated lesions, and insists on the following signs as necessary: (1) Palpable and much accentuated second pulmonic sound. (2) Gerhardt's sign. (3) Thrill felt in the jugulum. (4) Enlarged pulmonary artery in the *x*-ray picture. (5) Murmur in second left intercostal space, which in infancy is always systolic in uncomplicated cases, but as dilatation of the pulmonary artery develops, may extend into diastole.

Carpenter,[9] in a study based on extensive clinical material and autopsies, lays stress on the following points in diagnosticating patency of the ductus arteriosus: (1) A systolic murmur, loudest over the second left interspace, occasionally transmitted upward and heard in the interscapular region; in adults it is commonly prolonged into diastole, and is of a roaring, rumbling character. In children, on the other hand, this harsh character is lacking, and the prolongation into the diastolic period is of infrequent occurrence. (2) A thrill is not constant; it may be present over the pulmonary area, and when transmitted to the left clavicle is pathognomonic. (3) The second pulmonic sound is usually accentuated, but this sign is not essential to the diagnosis. (4) The presence of Gerhardt's dulness. (5) The *x*-rays constantly show an enlarged pulmonary artery. (6) The heart is not enlarged to the right.

Groedel,[10] who has studied a series of cases with the orthodiagraph, summarizes his findings as follows: (1) "Of all the congenital affections the persistence of the ductus arteriosus Botalli affords the most typical Röntgen picture. The most evident symptoms are the distention and pulsation of the pulmonary artery and the enlargement of the right ventricle by which a round heart is formed." (2) The heart may be normal in size or enlarged,

[8] Loc. cit.

[9] Congenital Heart Affections, British Jour. Child. Dis., 1909, No. 69, vol. vi.

[10] *X*-ray in Heart Diagnosis, Interstate Med. Jour, June, 1911; also Deutsch. Arch. f. klin. Med., 1911, ciii, 413.

depending on the presence of associated lesions. (3) The murmur may be systolic-diastolic.

Other observers have emphasized the significance of one or another physical sign, thus: Zinn[11] dwells on Gerhardt's dulness and absence of cyanosis; Dresler[12] lays stress on the transmission of the murmur to the left carotid; Dogutschagew calls attention to the asymmetry of the pulses; while Francois Frank[13] believes the audibility of the murmur in the interscapular space is of importance. Recently, E. Goodman[14] has collected all of the reported cases of patent ductus arteriosus, adding to them a carefully observed case of his own. His report covers 34 cases in which the diagnosis was corroborated by autopsy and 37 in which it was made purely on clinical evidence. He has carefully analyzed the various symptoms and signs present in each group of cases, concluding that no one particular physical sign should be considered pathognomonic, but rather that the diagnosis should rest upon the presence of a large number of different signs.

The following 5 cases of patent ductus arteriosus were seen by us during the past year. Four of these cases applied for treatment at one of the children's clinics at Mount Sinai dispensary, the fifth occurred in Mount Sinai Hospital in the medical service of Dr. Alfred Meyer, through whose kindness we are enabled to report it. All these cases were orthodiagraphed by one of us in the *x*-ray department of the hospital.

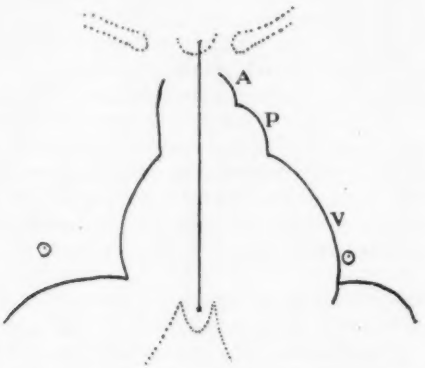

FIG. 2.—Case I. Transverse diameter, 9 cm.; normal diameter, 8 cm. At *P* is seen a large, pulsating pulmonary artery. Heart enlarged mainly to right, producing so-called "Kugel-herz" or round heart.

[11] Loc. cit.

[12] Beitrag zur Diagnose des Ductus a. Botalli, Jahr. f. Kinderheilk., 1902, lvi, 705.

[13] Gaz. Hebdomad., 1878.

[14] Report of a Case of Patent Ductus Arteriosus Botalli, with a Study of the Cases heretofore Published, Univ. Penna. Med. Bull., 1910-1911, No. 10, p. 509.

CASE I (Fig. 2).—Isidor S., male, aged six years.

History: Normal birth. Not a "blue baby," though fingers have always been somewhat bluish. Pertussis three years ago. No other serious illness.

Present illness dates back four weeks, since when the patient has had slight cough, malaise, and toward evening fever. Has lost considerable weight.

Physical Examination: Undersized, poorly developed boy. Moderate general cyanosis. Marked clubbing of fingers and toes. Lungs show general bronchitis.

Heart: Apex-beat visible and palpable in the fifth space in the nipple-line. Heart borders normal to percussion. There is a loud, rough systolic murmur heard all over the chest, with the maximum intensity over the second left intercostal space close to the sternum. Loud clear ringing second pulmonic sound, which is also distinctly palpable. Pulses equal, regular, of good volume. Heart apparently well compensated.

Urine negative. Von Pirquet reaction strongly positive.

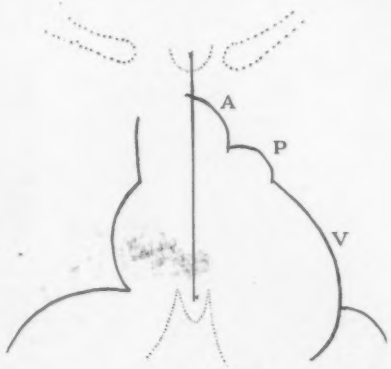

FIG. 3.—Case II. Transverse diameter, 7.5 cm.; normal diameter, 8.4 cm. At *P* is seen large pulsating pulmonary artery. Heart is not enlarged.

CASE II (Figs. 3 and 4).—Mollie N., female, aged four years.

History: Normal birth. Except for measles at two years of age has always been well. Was brought to the clinic for a slight cough of two weeks' duration. No loss of weight. No fever. No hemoptysis.

Physical Examination: Undersized girl. Good color. No cyanosis or clubbing.

Heart: By percussion enlarged to the right and left: Right border, second space, 2 cm. to right of midline; third space, 2½ cm. to right of midline; fourth space, 3 cm. to right of midline.

Left border: Third space, 4 cm. to left of midline; fourth

space, 5 cm. to left of midline; fifth space, 5½ cm. to left of midline.

In the left second space there is parasternal dulness extending 2 cm. from the midline. Apex impulse diffusely felt in the fourth and fifth spaces in the nipple line. Action regular. Normal rate. Inconstant faint, rough systolic murmur at apex. In the left second space there is a loud rumbling systolic murmur heard during the greater part of the cardiac cycle, transmitted to the vessels of the neck and downward to the third space. It is not heard in the back. Pulmonic second sound slightly accentuated. Faint thrill in the jugulum and over second left interspace close to the sternum. Pulses equal, good quality. Urine negative.

FIG. 4.—Case II. Roentgenogram, showing at *P* prominence of pulmonary artery. Comparison with the orthodiagram (Fig. 3) shows the advantage of the latter in point of clearness. From a study of the Roentgenogram alone a diagnosis in this case would not be possible.

CASE III (Figs. 5 and 6).—Esther G., female, aged four and one-half years.

History: Normal birth. No cyanosis. Measles at two years. Pertussis and varicella at three years. Was brought to the clinic for a slight cough, which has troubled her for two weeks.

Physical Examination: Undersized child. Over left temporal region there is an area of bluish-black discoloration about the size of a silver dollar (Mongolian spot). General color good; no trace of cyanosis. No clubbing of fingers or toes.

Heart: Apex beat not visible; impulse felt in the fourth and fifth spaces in the nipple line. Precussion shows the borders as follows:

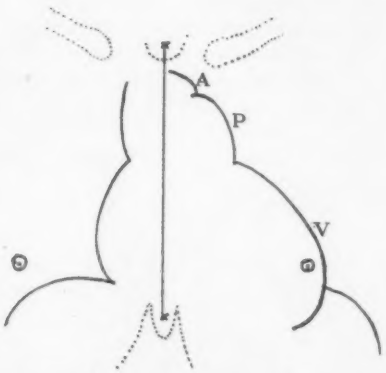

FIG. 5.—Case III. Transverse diameter, 7.7 cm.; normal diameter, 7.9 cm. At *P* is shown a very large pulsating pulmonary artery. Heart appears otherwise normal.

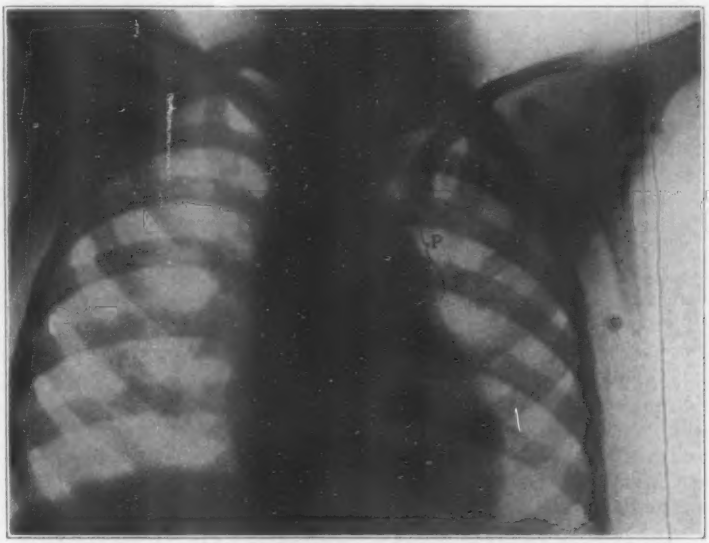

FIG. 6.—Case III. Roentgenogram, showing at *P* a very large pulmonary artery.

Right border, second space, 1 cm. from midline; third space, 1.5 cm. from midline; fourth space 2 cm., from midline.

Left border, second space, 2.5 cm. from midline; third space, 3.5 cm. from midline; fourth space, 5 cm. from midline; fifth space, 7 cm. from midline.

Action regular. Rate normal. First sound at apex is accompanied by a short, rough, systolic murmur transmitted toward the axilla. There is a loud rough, systolic murmur heard best in the second left space, less loud in the third and fourth spaces. It is transmitted to the carotids, and is heard in the left interscapular region. The second pulmonic sound is distinctly loud, but not palpable or ringing. Pulses equal, good quality, regular.

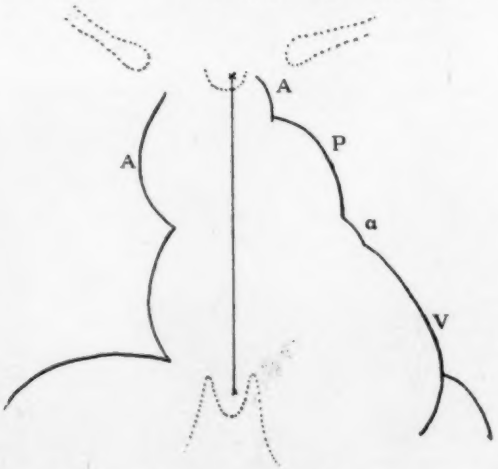

FIG. 7.—Case IV. Transverse diameter, 10.1 cm.; normal diameter, 9.1 cm. At *P* is seen a large pulsating pulmonary artery. Ascending aorta, *A*, is much dilated; enlargement of heart to left.

CASE IV (Fig. 7).—Joe I., male, aged eight and one-half years.

History: Normal birth; no cyanosis. Measles and pertussis in early childhood. For the past year has had headache and occasional vomiting and sticking in the precordium. Night-starts.

Family History: Six children. No cardiac complaints.

Physical Examination: Well nourished. No cyanosis or clubbing. Heart: The right border is 2 cm. to the right of the midline. The left border 9 cm. to the left of the midline. There is a band of dulness to the left of the sternum in the second space. The action is regular and the rate normal. In the second left space there is a rough systolic murmur, transmitted slightly upward. The second pulmonic sound is loud, and is accompanied by a short, rough, distolic murmur heard also in the third space. There are no murmurs over the aortic area. The first sound at the apex is slightly impure. No thrill. Pulses are equal, regular, not of the water-hammer type. No capillary pulse.

CASE V (Fig. 8).—A. S., male, aged thirty years.

History: Family history negative for tuberculosis and cardiac disease.

Past History: Normal birth. Rheumatism fifteen years ago. For past few months has had a cough; slight fever, and chilly sensations.

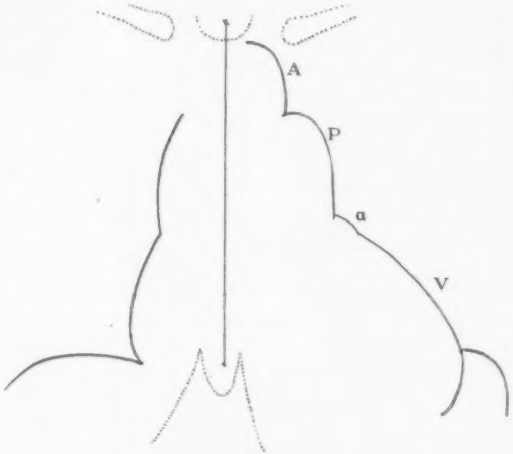

FIG. 8.—Case V. Transverse diameter, 13.6 cm.; normal diameter, 13.2 cm. At *P* is seen a much enlarged and pulsating pulmonary artery.

Present Illness: In hospital at present for mild polyarticular inflammation. At various times while in hospital he developed crops of small subcutaneous nodules, probably tuberculides.

Physical Examination: Well-nourished man. No cyanosis or clubbing. Lungs: Signs of moderately advanced bilateral tuberculosis. Sputum contains tubercle bacilli. Heart: Percussion shows no increase of heart dulness. To the left of the sternum there is dulness in the second space. There is visible pulsation over the pulmonic area. No thrill felt. There is distinct pulsation present in the jugulum. The action is rapid and regular. There is a loud rough systolic murmur best heard over the third left interspace and not transmitted. The second sound over the pulmonic area is accentuated.

To review briefly the salient features of the above 5 cases reference should be made to the table on page 553. It will be seen that though all the cases presented a distinct cardiac lesion, only one of them complained of subjective symptoms. All the hearts were compensated. Cyanosis and clubbing of the fingers were present only once, and 2 of the cases were suffering from pulmonary tuberculosis. A rough basic systolic murmur was uniformly

present. It was best heard over the pulmonic area, and in 1 case extended throughout the cardiac cycle. This murmur was usually transmitted to the neck, and in only 1 case was it heard in the left interscapular region. With one exception the size of the heart as determined by percussion was normal, and in one other case the orthodiagram showed an enlargement to the right. The second pulmonic sound was in all cases distinctly accentuated and of pure quality, and the closure of the pulmonary valves was palpable in one patient. A thrill was found in one case only, and it was faintly felt in the jugulum and over the pulmonic area. Parasternal dulness (Gerhardt's sign) was elicited in 4 of the patients, but was not noted in one case.

There is, therefore, a distinct similarity in the physical signs shown by these 5 cases, and one is further convinced of this by the *x*-ray findings. In 2 of the cases (Nos. 2 and 3) radiographs were made, and the accompanying reproductions show a distinctly prominent shadow in the region of the pulmonary artery (Figs. 4 and 6). It is, however, in the orthodiagraphic pictures (Figs. 2, 3, 5, 7, and 8) that the enlargement of the pulmonic shadow is most beautifully shown. In each picture the bulging of the pulmonary artery (*P*), before referred to, is evident, and is easily seen when compared with the diagram of the normal heart (Fig. 1). On fluoroscopic examination the pulsation of this pulmonic shadow was the dominating feature of each picture.

As regards the size of the hearts, only one case showed enlargement to the right (Fig. 2), and one case showed enlargement to the left (Fig. 7).

The shape of the heart as revealed by the orthodiagraph is also of importance. Three of the 5 cases are of normal shape. Of the 2 others, one has evidence of left ventricle hypertrophy and dilatation; the other shows an enlargement to the right and a rounded shape (Kugelherz), characteristic of right-sided enlargement. These 2 cases differ from the others not only in their fluoroscopic appearance, but also in their physical and clinical manifestations. Examination of Fig. 7 shows a dilated pulsating ascending aorta, with hypertrophy and dilatation of the left ventricle. This is the characteristic appearance found in stenosis of the aortic isthmus, a lesion commonly associated with patent ductus arteriosus, and aortic insufficiency has probably developed. It is incidentally of interest to note that this case with its secondarily acquired lesion is the only one showing any subjective cardiac symptoms. The other case in which there is a variation from the normal configuration is shown in Fig. 2. In this case an associated congenital lesion had been suspected, owing to the marked clubbing and cyanosis it presented. According to Hochsinger there is a probability of combination with pulmonary stenosis, when there is marked hypertrophy of the right ventricle and a high grade of cyanosis in the early years of life.

TABLE SHOWING SIGNS AND SYMPTOMS OF THE FIVE CASES REPORTED.

Case. No.	Age.	Sex.	Subjective symptoms.	Clubbing of fingers.	Cyanosis.	Size of heart.	Systolic Murmur.	Transmission of murmur.	Other murmurs	Character of second pulmonic sound.	Thrill.	Gerhardt's sign.	Frank's sign.
I	6 years	M.	None	Marked	Marked	+ to right; "*Kugel*" shape	All over chest, loudest over pulmonic area	Over entire chest	None	Loud ringing, palpable	None	Not elicited	Not elicited.
II	4 years	F.	None	None.	None	Normal	Rumbling over greater part of cardiac cycle. Loudest over second left space	To neck and downward to third space	Faint rough systolic at apex	Slightly accentuated	Faint, in jugulum and over second space	Present	Absent.
III	4½ years	F.	None	None	None	Normal	Rough. Over second left space	To carotids	At apex a short systolic transmitted to axilla	Accentuated.	None	Present	Present.
IV	8½ years	M.	Slight precordial pain. Sleep-starts	None	None	+ to left; "aortic" shape	Rough over second left space	Slightly upward, but not to neck vessels	Soft diastolic in second left space transmitted to third space	Loud	None	Present	Absent.
V	30 years	M.	None	None	None	Normal	Rough over third left space	None	None	Loud and accentuated	None	Present	Not elicited.

From the study of our orthodiagrams, therefore, it appears that in pure patent ductus arteriosus one need not expect enlargement of the heart or alteration of its shape, and that the presence of these changes suggests an associated or complicating lesion.

Differential Diagnosis. One lesion with which patent ductus arteriosus may be confused is pulmonary stenosis, inasmuch as the physical signs are much alike. Hochsinger insists that the diagnosis of patent ductus Botalli should not be made in the absence of a much accentuated second pulmonic sound. A second pulmonic sound of normal intensity, or one which is impure, at once suggests diseased pulmonic valve cusps which do not vibrate in response to the increased pressure in the artery—most probably pulmonic stenosis. It appears that in pulmonic stenosis the pulmonary artery may be congenitally hypoplastic, causing it to dilate under the influence of pressure, so that on viewing it with the *x*-rays it appears enlarged. This was the case in the patient reported by Arnheim,[15] in which a diagnosis of patent ductus arteriosus was made, in which, however, at autopsy an extreme pulmonic stenosis was revealed. Hochsinger, in discussing this case shows that there was absent pulmonic second sound, which should have thrown out the diagnosis of patent ductus arteriosus. It is of interest to note that in his article Arnheim makes no mention of having watched the heart in action, confining himself to an *x*-ray plate. It seems highly improbable that the large pulmonary artery he pictures would have shown the wide pulsation as we have seen in all of our cases. In the presence of extreme narrowing of the pulmonary artery one would not expect a marked systolic expansion of the shadow, and we believe that had Arnheim fluoroscoped his case the error in diagnosis might have been avoided.

In Burke's 3 cases[16] of pulmonic stenosis with autopsy, in which during life a patent ductus was diagnosticated because of accentuated second pulmonic, there is no record of fluoroscopic examination; so that this observer did not avail himself of perhaps the only means of diagnosis which would have been differential.

There is one other condition in which the pulmonary artery may be much enlarged—namely, mitral disease. We have, however, been able to convince ourselves by frequent fluoroscopy of these cases that the pulmonary artery in this condition while enlarged, pulsates little if at all. In this connection the case of patent ductus arteriosus reported by Kate Campbell Mead[17] is of interest. In this case the diagnosis of patent ductus was made by Dr. Thayer, to whom the patient had been referred. Two years later a laryngeal par-

[15] Persistenz des Ductus Botalli, Berl. klin. Woch., 1903, No. 27, and 1905, No. 8, p. 206.

[16] Zeitschr. f. Heilkunde, 1902.

[17] Persistent Patency of the Ductus Arteriosus, etc., Jour. Amer. Med. Assoc., December 24, 1910.

alysis appeared and the patient was *x*-rayed. The *x*-ray picture shows a cap-like prominence in the pulmonic region, which, however, is interpreted in the radiographer's report as the shadow "due to an hypertrophied and dilated left auricle, secondary to an insufficient mitral valve." No mention is made of fluouroscopy, and it is certain that observation of this case by means of the fluoroscope would also have shown the characteristic silhouette and pulsation.

We believe that a comparison of the clinical findings and the fluoroscopic appearance of our cases with those reported in the literature corroborated by autopsy fully justifies our diagnosis of patency of the ductus arteriosus.[18] Furthermore, we are impressed by the importance and value of fluoroscopic examination, and believe that diagnosis is distinctly aided by careful observation of the heart in action.

We wish to express our thanks to Dr. Jaches, of the *x*-ray department of Mt. Sinai Hospital, for courtesies extended during the course of this work.

A STUDY OF EMPYEMA, WITH SPECIAL REFERENCE TO THE FEASIBILITY AND IMPORTANCE OF DEPENDENT DRAINAGE.

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(Concluded from March, 1913, p. 422.)

MASSIVE (PARIETAL) EMPYEMAS

Case I.—On February 13, 1906, I operated for the late Dr. Southwick on a girl, aged seven years, who had been rapidly accumulating a pleural effusion on the left side, soon after the crisis of a double pneumonia. The dulness was general and the dyspnea marked. Temperature, 101° F. Paracentesis was done in the seventh interspace in the scapular line for the relief of the dyspnea and for diagnosis. About a quart of purulent fluid was

[18] In another case to be reported by Dr. M. Manges, in whose service it occurred, the diagnosis of patent ductus arteriosus was made. This case was orthodiagraphed by one of us (H. W.), and the fluoroscopic appearance was found to be identical with that of the cases described above. The patient died of carcinoma a few weeks later, and at autopsy patency of the ductus arteriosus was found.

drawn. Two days later about 1½ inches of tenth rib was resected in the scapular line and more pus evacuated. The index finger introduced through the wound could not touch any part of the lung except a substance with a velvety feel in the direction of the spine. This was probably collapsed lung. When the finger was turned downward it could easily feel the bottom of the pleural cavity and the twelfth rib and came against the diaphragm. The opening was extended across the interspace to the top of the eleventh rib. Two large drainage tubes were introduced about 5 inches and sutured to the edges of the wound and the usual large dressing was applied. Three days later the tubes were removed and the finger again introduced. It could now touch lung which was evidently reëxpanding. As the opening was fairly large a portion of the lung could be seen. The patient was much improved. Temperature, 99° F. About 1 inch of each tube removed before replacing them. Eight days later and eleven days after the operation, when I saw her again, the finger recognized a decided gain in expansion of the lung. As on the last visit it passed into the fissure between the two lobes, which now had come closer together, and the external surface of the lung closer to the chest wall. One week later the finger failed to recognize any gain in expansion, and forced respiratory apparatus with two bottles was advised. In the following two weeks only slight gain was evident. On April 15, the tubes were removed and two weeks later the sinus had closed.

Case II.—Man, aged thirty years. Right-sided croupous pneumonia began March 13, 1906, when Dr. Winslow Drummond was called. Had his crisis in nine days, which was followed by a short period of undisturbed convalescence, and this in turn by an increasing disturbance on the same side of the chest. Pleural effusion recognized March 26. A few days later aspiration tried at several points without obtaining pus or other fluid. I saw the patient first on April 5 and by that time the dulness extended from the bottom of the chest upward to the third rib anteriorly and the spine of the scapula posteriorly. Breath sounds over the dull area were absent or indistinct. Patient admitted to the University Hospital, in the service of Professor J. William White, April 6. On the same day a large veterinary hypodermic needle introduced in the ninth interspace, with an upward slant to avoid the diaphragm, and a few drops of thick pus obtained. On the following day about 2 inches of the tenth rib removed and empyema opened, a large quantity of thick pus escaping. A finger introduced felt a small portion of collapsed lung. Two large rubber drainage-tubes introduced about 3 inches and sutured to margins of wound, a safety-pin being passed through each for further safety against falling in of the tubes. The space around and between the tubes was packed with gauze strips. Temperature dropped to normal in a few days and the patient's general condition rapidly improved

Air could be heard sucking through the opening until the end of the sixth week. The last tube was removed about the end of the eighth week, and two weeks later the sinus was closed. As it seemed that the large opening necessitated by the two tubes allowed too free an entrance of air I concluded to use only one tube after this.

CASE III.—Boy, aged four years. Referred by Dr. B. F. Wentz. Admitted to the University Hospital, in the service of Professor J. William White, November 10, 1908. On the preceding day Dr. Wentz had found pus with the needle. The boy had been taken with left-sided croupous pneumonia about three weeks before, and had his crisis on the tenth day. He did not recover completely, and during the last few days was feeling much weaker than since the crisis had occurred. The dulness covered almost the whole left side of the chest, but there was slight resonance over the upper part of the scapula. On the day of admission, with the patient in the prone position, suggested by Elsberg, I excised about $\frac{3}{4}$ inch of the eleventh rib near the spine, in the manner already described. On introducing my finger into the cavity I detected an apparently uniform layer of soft fibrin, $\frac{3}{4}$ to 1 inch thick, covering the pleural surfaces, parietal and diaphragmatic, as far as the finger could reach. A small portion of it was wiped off with the finger and removed. No traces of this fibrin were found later in the dressings. An attempt was made at one time to employ negative tension drainage, with the method described by Schley, but a sudden rise of the temperature and illness of the patient caused me to give it up very soon. The patient was discharged from the hospital, with the tube removed, on December 6. Dr. Wentz reported the sinus closed December 14, thirty-four days after the operation.

CASE IV.—Boy, aged seven years, under the care of Dr. W. Drummond. Had severe erysipelas of the face and neck at nineteen months and a bilateral bronchopneumonia at five years of age. Since then has been strong and healthy. On February 12, 1909, was taken ill with influenza. Four days later had recovered sufficiently to return to school. On the following day, however, he was seized with a severe pain on the left side of the chest. On February 19, his temperature was 101°; pulse, 98; respiration, 42, and croupous pneumonia was diagnosticated. Two days later the temperature had reached 105$\frac{2}{5}$° F., and the boy seemed septic, so that Dr. Drummond began to suspect an empyema and tried a small hypodermic needle without obtaining pus. On February 27, Dr. J. H. McKee was called in consultation, concurred in the diagnosis of empyema, and obtained a large quantity of pus by aspiration. On the following day, at the child's home, I excised about an inch of the eleventh rib near the spine (Fig. 1), with the patient in the prone position. I happened to look at a clock as

I was about to make the stab wound for the introduction of the exploratory probe and I concluded to time the operation. When the tube was in and the dressing was being applied from four to five minutes had elapsed. The temperature reached normal on the third day after operation. On the sixteenth day it rose suddenly to $102\frac{3}{5}°$ and the patient looked ill. The tube was removed and a plug of fibrin washed out when it was replaced. On the following day the temperature rose again, but after that there was no further trouble. The sinus was not closed until the ninth week, and in this case the sucking in of air on inspiration was heard until about two weeks before the sinus closed.

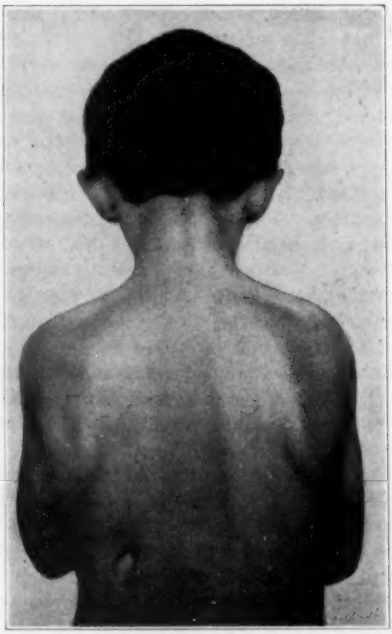

FIG. 1.—Scar at bottom of left side of thorax, posteriorly, after drainage of a massive empyema by excision of small portion of eleventh rib. Inferior angle of scapula normally is opposite seventh intercostal space.

CASE V.—Boy, aged eight years, under the care of Dr. C. L. Felt. Was taken with right-sided pneumonia October 17, 1910. Had his crisis in the usual time, but did not fully recover afterward. Dr. J. H. McKee was called in consultation and confirmed the diagnosis of empyema. On November 6, at the patient's home, I excised a small portion of the eleventh rib, as in the preceding cases. A large quantity of pus was evacuated and a half-inch

rubber drainage-tube introduced and fixed to the margins of the wound. I saw the patient only a few times after the operation, Dr. Felt taking charge of the after-treatment. He reported the sinus closed January 3, 1911, about eight weeks after the operation.

SMALL (INTERLOBAR?) EMPYEMAS.

CASE VI.—This case was reported in conjunction with Dr. J. H. McKee before the Philadelphia Pediatric Society in May, 1906. The patient was under the care of Dr. McKee, who made the diagnosis and located the pus collection. The following is the brief report of the case which I made[1] and the reference to the condition as a "localized or encysted" empyema was made before I had concluded that practically all acute empyemas are localized or encysted. "The opening in the chest wall, made by a resection of about 1 inch of the sixth rib in the midaxilla on the left side, led directly into the cavity. That the empyema was a localized or encysted one was shown by the fact that the lung was adherent to the parietal pleura in the circumference of the empyema, which was demonstrated by the exploring finger. That the pus collection was in the fissure was evident from the depth of the cavity, which was approximately in the normal situation of the fissure dividing the two lobes of the left lung, and from the fact that the finger came directly upon the heart, covered by the pericardium. Drainage was provided by two good-sized rubber tubes, introduced in the direction of the spine for about 5 inches. These were gradually shortened and healing was completed in five weeks. At the time of the operation the finger entered a roomy cavity, the walls of which were apparently under the influence of external atmospheric pressure. Soon afterward it could be determined through the wound by the eye and finger that the cavity was becoming filled by the expansion of the collapsed portion of the lung, this being aided by coughing and forced respiratory exercises."

CASE VII.—Boy, aged two years, under the care of Dr. W. Drummond. Had apparently recovered from right-sided croupous pneumonia, which developed at the end of a three months' illness, including repeated "colds" and a glandular abscess of the neck. He did not remain well after the crisis, and on suspecting an empyema, Dr. Drummond called Dr. J. H. McKee in consultation on February 7, 1908. While dulness was found over the greater part of the left side of the chest it was most marked in the midaxillary region between the sixth and ninth ribs. Aspiration in the seventh interspace gave no pus, and it was repeated in the eighth interspace. No pus appeared on this trial until the needle was with-

[1] International Clinics, 1906, cxi, 159

drawn, when immediately the inside of the bottle was spattered with pus spots, a small quantity appearing at the site of the puncture. On the following day, under chloroform administered by Dr. A. G. Tinney, and with the assistance of Dr. Drummond, I first made a stab wound with a narrow bistoury at the site of the aspiration puncture. A probe with the end bent slightly was introduced, but it could not be moved about freely inside the chest, and its end could not be turned downward. About an inch of the rib below was excised. The pleura was broken through by a grooved director, but only a small quantity of pus escaped. This opening was enlarged and a finger introduced, which found itself in a very small space, with the drainage opening at its lowest limit and the lung adherent to the chest wall all around the cavity. A drainage-tube with a half-inch lumen was introduced, sutured to the margins of the wound, and the dressing applied. The quantity of pus which escaped was small and about two tablespoonfuls of a fibrinous material escaped also. After the operation the child did not improve rapidly and continued to cough considerably, the temperature retaining the same septic type as before the operation. February 15 it was noted that he seemed to cough up a considerable quantity of fluid, which could not be inspected because it was immediately swallowed. It may have been the result of the breaking into a bronchus of a second pus collection, as he improved after this for a short time. February 24, the patient had been worse for a few days, and an examination showed an area of dulness just anterior to the upper part of the axilla. Under ether anesthesia aspiration was tried here, but no pus was obtained. The finger was then introduced into the drainage opening, but found itself in the same circumscribed cavity as in the first operation, and brought out a considerable amount of the same fibrinous material as escaped at the first operation. On February 28, on account of the continued sepsis, the tube was removed and the cavity packed with iodoform gauze, but this was stopped and the tube reintroduced in a few days. The area of dulness above persisted, and on account of the continued symptoms of sepsis it was thought that there must be a second pus collection, indicating further operation. Dr. McKee was again called in, but advised against operation. The child was slowly improving, although the temperature still continued to be irregular and about as high as before the operation. Although the cavity was a small one from the beginning, on account of the septic character of the temperture it was thought advisable to allow the tube to remain. On April 24, it was concluded to remove the tube, regardless of the temperature. A few days later the temperature came down to normal and in about ten days the sinus was closed. The patient has continued well ever since and at the present time is in perfect health.

CASE VIII.—Girl, aged eleven years, a private patient in the Germantown Hospital, under the care of Dr. Perry Cummings, who had called in consultation Dr. J. H. McKee. The patient had had right-sided pneumonia and the temperature had fallen by crisis, but had remained normal only a few days. When I first saw her, January 15, 1910, the relapse had lasted about a week, the temperature rising each afternoon to 104° and 105° F., and falling in the morning to about normal. The pulse remained at about 100 to 110 and the respiration at about 40. There was a localized area of dulness, reaching from about the third interspace above to the liver dulness below, and from the sternum to the anterior axillary line. About four days before a hollow needle had been introduced in this dull area, in the third and fourth interspaces, without obtaining pus. It was thought that the needle had not passed into lung tissue. Air had rushed into the chest through the needle, indicating that the visceral and parietal pleuræ were not adherent to each other in the dull area. An *x*-ray taken seemed to show a small empyema nearer the posterior than the anterior surface of the lung. After a consultation it was concluded that a pus collection was present and that the lung should be exposed for further exploration and the evacuation of a pus collection, if found. On the following day, January 16, the patient was given chloroform by Dr. McKee, and I exposed and removed subperiosteally about $1\frac{1}{2}$ inches of the fourth rib and cartilage. The pleura was then carefully opened after it was picked up by forceps. The lung was adherent to the parietal pleura by delicate adhesions. While separating these in the effort to locate the horizontal fissure of the lung the air began to enter the pleural cavity and the lung slowly to collapse. The lung was quickly grasped with a double tenaculum and drawn into the wound to plug it against the further entrance of air, and the lung was sutured to the circumference of the wound margins to permanently shut off the pleural cavity. A veterinary hypodermic needle was then introduced nearly its whole length into the lung four times in various directions, the piston being withdrawn each time. The results were unsatisfactory, only a small quantity of fluid being withdrawn each time, and that so mixed with blood that its significance could not be determined. The last puncture was made with a slight upward slant of the needle, and after removing it and expelling its contents into a basin it was observed that there were two small white spots in the fluid withdrawn. It was concluded that these showed the presence of pus. The actual cautery was then passed about $1\frac{1}{2}$ inches into the lung in the direction of the last puncture, but no escape of pus followed it. A closed hemostatic forceps was then introduced into the lung opening, forced about an inch deeper, and the blades opened slightly. There immediately followed a gush of fluid, the nature of which could not be

determined because of the blood present. The fluid flowed too easily to be pure pus, but it was not blood because the flow ceased immediately. None escaped into a bronchus. The quantity could not be determined, but according to my judgment there were about 2 ounces. The finger passed into the lung wound found what seemed to be a small cavity, with smooth walls which contrasted with the rougher surfaces of the rest of the wound. During the manipulations with the finger, which were gentle, air was heard entering the thoracic cavity and was evidently passing through the lung wound. It is likely that the collection of fluid was in a fissure and that the finger had broken down the circumscribing adhesions in it, so that the pleural cavity was again opened to the outside air through the lung wound. A strip of gauze was immediately packed into the lung wound, shutting off the new opening into the pleural cavity, and the whole wound was thus tightly packed to the skin surface. The skin wound was partly sutured, a dressing applied and held in place by a bandage. The patient was returned to bed in good condition. The external dressing was changed daily, but the packing in the lung wound was allowed to remain until the sixth day, when it was removed under nitrous oxide anesthesia. A rubber tube was then introduced and packed around with gauze, but the tube was removed on the following day and was not replaced afterward, only light gauze packing being employed. Soon after this the packing was done away with entirely, the gauze being merely laid over the wound. The temperature fell to normal on the day after the operation and remained practically so during the convalescence, the wound being almost completely closed on February 14. The patient has since done very well and is now in good health.

Case IX.—Girl, aged four years. Referred by Dr. B. F. Wentz. Right-sided pneumonia began March 27, 1910, and crisis occurred April 9. The convalescence progressed favorably four or five days, when the patient began to get worse, and there was detected some dulness and other signs of a pleural effusion, including fever and cough. May 18, the dulness reached as high as the third rib anteriorly. Aspiration was done in the seventh interspace in the midaxillary line, but only about 2 ounces of pus were obtained. The patient was admitted to the University Hospital May 19, in the service of Professor J. William White, and operation was performed on the same day. The exploratory probe introduced through the preliminary stab wound was too flexible to serve the purpose well but seemed to reach the eleventh interspace near the spine, although it was recognized that its bent end could not be felt under the eleventh interspace as well as in the preceding large empyemas. The eleventh rib was exposed and a small portion excised. The probe did not push easily through the pleura from the inside as usual, and the pleura was picked up with two

forceps, as in opening the peritoneum, and was carefully incised. This exposed muscle fibers, which were evidently of the diaphragm. A grooved director was then substituted for the probe, and was pushed from within out through the lower opening by keeping it close to the chest wall. No pus appeared. The lower opening was then closed by sutures, a small drain being left in the lower angle. The ninth rib was then exposed and about 1 inch excised. The pleura was opened and a finger introduced, which found a small collection of pus, the escape of which was not accompanied by the usual inrush of air. Percussion showed that the dulness extended as high as before. A veterinary hypodermic needle introduced posteriorly in the seventh interspace withdrew pus. As this puncture was within the reach of the finger from the opening made by the excision of the ninth rib, the finger was introduced in the latter and by keeping it close to the chest wall it was passed upward toward the site of the last puncture when a freer escape of pus occurred than before and air was heard sucking into the chest on inspiration. The quantity of pus escaping, however, was not free enough to indicate the presence of the usual massive type of empyema. A drainage-tube about a half-inch in diameter was introduced and sutured to the margins of the wound, a safety-pin being passed through the tube for added safety. The tube was removed June 6. The patient had left the hospital at the end of the third week with the tube in. The sinus closed during the last week in June, five or six weeks after the operation. The facts that the pus did not extend to the bottom of the pleural cavity and the quantity of pus present was only moderate in amount, together with the fact that it did not escape easily at first through the second opening, suggests the possibility or probability of an interlobar empyema in this case.

SUMMARY. Our knowledge of the mechanical and pathological conditions existing in connection with empyemas has made little progress from observations made at operations or even autopsies. A formalin-hardened cadaver specimen of an empyema undisturbed by an opening during life is difficult to obtain, and therefore rare. For this reason such a specimen affords a particularly valuable opportunity for study. From a study of such a specimen and a small number of clinical cases the writer draws a few inferences which are at variance with the generally accepted views. They are as follows: We have not properly appreciated the extent and the nature of the adhesion formation developing in connection with empyemas, especially the acute variety. The massive parietal type extends usually to the bottom of the normal pleural cavity, and is not unencysted or general, but completely walled off above from the rest of the pleural cavity by adhesions. This explains the slight movability of the dulness on percussion, after changing the position of the patient, as well as the fact that the upper level

of the dulness is not in a straight line as it should be if the fluid was unencysted and free to seek its own level. Skoda's resonance may not be due to relaxation of the lung above the pus, but to the fact that the functionating portion of the lung is doing compensatory work.

The probability is that adhesions between the lung and chest wall will not offer a serious obstacle to the reëxpansion of the lung, because they develop between parts normally in contact. The fact that a double empyema can be safely opened on both sides at the same operation is to be explained by the fact that the air admitted does not produce a total double pneumothorax, since it enters on each side only the firmly walled-off empyemic cavity. Total collapse of the lung is prevented by the firm adhesions which protected the lung against the pus pressure before the drainage opening was made. There is no sudden or dangerous change of pressure on the thoracic organs from the usual rapid evacuation of the pus, but a gradual substitution of the pus by air, which has a pressure of 15 pounds to the square inch.

The so-called encysted or localized empyemas are small, probably because they develop in the fissures of the lung or between the lung and diaphragm, and therefore because of the difficulty with which the pus is diffused in these situations.

The most important factor in preventing the obliteration of the empyemic cavity and closure of the sinus is the pressure of the air admitted through the drainage opening into the empyemic portion of the pleural cavity, where it neutralizes the expanding effect of the air coming through the trachea. Murphy overcomes this completely by aspirating the pus and injecting a formalin-glycerin solution, but his method has not yet received general approval. The drainage methods still prevail. The ideal drainage method is that based upon the suction or siphon principle. Its chief objection is that the devices in use for applying it generally leak air around the tube. We have not yet determined how rapidly an empyemic cavity, which is an abscess, may be permitted to close.

The size of the drainage opening has an important bearing upon the later expansion of the lung. The lung probably cannot expand until the entrance of air through the drainage opening is so diminished by contraction of the opening and blockage of the space in and around the tube by the escaping pus, that with absorption of the air already in the cavity there is developed a negative tension external to the lung sufficient to permit the normal internal pressure coming through the trachea to become greater than the external pressure. For this reason we cannot safely employ in empyemas the large drainage opening as in ordinary abscesses. The effect of the large opening in empyemas is shown after the Estlander operation by the permanent non-expansion of a considerable portion of the affected lung. An opening through the eleventh

rib or interspace of a given size will drain more perfectly than one at the usual level, and will better prevent the entrance of air, since the pus will be constantly escaping and tending to fill the space in and around the tube. There will be little or no danger of the drainage-tube falling into the empyemic cavity, since it must travel against gravity to do so, and if this accident happened the tube probably could easily be reached and removed with a forceps, because gravity would prevent it from moving away from the opening. In some cases the much-thickened pleura is the result probably of the organization of layers of fibrin deposited in the acute stage.

Of the five massive empyemas treated with dependent drainage it may be said that the time necessary for a cure was less in all than the average determined by Schädler, fourteen and one-half weeks, or the average in Fraley's cases, ninety days, and therefore there were no persistent sinuses. In the 9 cases there were no deaths. The method deserves further trial and study.

THE EFFECTS OF EXPOSURE TO INTENSE HEAT ON THE WORKING ORGANISM.[1]

By Charles N. Fiske, M.D.,
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The navy has been consulted in the matter of affections caused by heat and other attending conditions of the atmosphere in which its men work, because this class of disability has attracted attention in the public press and occasional medical reports, either in time of war or in the course of cruises in which the reading public is more or less interested, by reason of prostrations and deaths being noted in published dispatches.

The accompanying statistical table, which records but twenty deaths and thirty-three invalidings from the service on account of heat-stroke during the last thrty-five years, and the damage curve would indicate that heat prostration has been of comparatively little importance to the service as a whole; however, from the excerpts from sanitary reports of naval medical officers to follow and the fact that considerable numbers of cases have on occasion jeopardized the strategic or diplomatic mission of a particular warship, the deep concern of the immediate hygienist will appear to be justified.

[1] Read in Section IV, XVth International Congress on Hygiene and Demography, Washington, D. C., September 24, 1912.

Heat prostrations were coeval with the "new navy" of the last quarter century, which found its beginning in the famous "white squadron;" correspondingly as that early class of all steam-propelled cruisers and gunboats has been retired, and its lessons in sanitation, and notably in ventilation, have been used profitably in the design and equipment of all but the earliest class of battleships and armored cruisers, the factor of heat-stroke in the navy has assumed relatively a low value during the last few years.

Naval hygenists, who have agitated changes in construction, arrangement, and ventilation of ships will represent that the service has largely solved the problem, while other observers will, with perhaps equally good reason, maintain that the difficulty has solved itself on account of smaller boilers and more economical leads of steam pipes and arrangements of pumps, etc., in the engine rooms of large ships. The latter view, however, is refuted by the still lower location of dynamo and steering engine compartments, and in the main it will be evident that improved facilities for ventilation, whether natural or artificial, have achieved the subsidence of heat prostration. It is only when a radically new type of ship is placed in service that faulty and inadequate ventilation any longer occasions suffering and disability from undue atmospheric heat and humidity, as has been recently shown to occur on the first ships of the *Dreadnaught* type.

At their worst, heat affections have developed only on isolated occasions, and then only on comparatively few ships, and doubtless many cases have been so trivial that they have hardly been recognized as of such a nature in the absence of severe cases.

This statement will prepare the physiologists and pathologists who look for some apology or explanation for the naval surgeons not making more definite contributions and exact observations relating to the fairly typical cases of heat exhaustion that occur in the service. It is perhaps thought that with his training, time, equipment, and opportunity to study the condition at its inception, something more than a mere compilation of general data should be available from the reports of naval surgeons for this paper. Such versatility, however, as the wide range of duties demands of naval medical officers, together with the lack of experience and apparatus to make the precise observations which would enable physiologic study to withstand criticism, and the uncertainty of having the cases, which nearly always occur under the unusual and unanticipated conditions on a ship in the tropics, remote from laboratories, as well as the fact that these occasions are likely to find the doctor most busy, preclude the contributions for which we all seek, and which should be more practicable near steel mills, for instance, where cases frequently may be expected and where provision can be made for such study.

The perusal of the literature of disorders attributed to heat

tends to confuse the student first as to nomenclature and terminology and almost hopelessly as to etiology. Within the naval reports comparatively few titles have been used, probably fewer than if more had been available on the printed classification, and save for the quotations from the text of the reports themselves, little dependence can be had upon just what train of symptoms a title was used to cover some fifteen years ago when heat affections were most prevalent in the navy. For these reasons I have combined in the table all heat cases without regard to prevailing nosology.

One of the earliest references to heat prostration in the fire rooms of ships published by an American naval surgeon is the following by Medical Inspector A. L. Gihon, in his *Naval Hygiene*, of 1872:

"The symptoms of insolation often occur among men not exposed to the direct rays of the sun—in the fire room of steamers, on board the monitor class of armored vessels, in small, ill-ventilated cells. Dr. Kitchen informed me that while surgeon of the monitor *Dictator* it was common for men to be brought to him for treatment with coma, stertorous breathing, great heat of skin, full, quick pulse, and often convulsions. The cause was manifestly enough the exhausting labors of a watch in the fire room, where the temperature averaged 145°, and where the ventilation was exceedingly defective, air that had been already respired being repeatedly returned. Maclean states that 'insolation has frequently been observed on board ship, but almost always under conditions similar to those in barracks—that is, where overcrowding and impure air are added to the influence of excessive heat. Insolation is not uncommon on board the mail steamers in the Red Sea in the months of August and September; it has been observed that most of the cases occurred while the sufferers were in the horizontal position in their ill-ventilated cabins,' and he quotes the following: 'Assuredly,' says Dr. Butler, surgeon of the third cavalry, 'those barracks most crowded, least ventilated, and worst provided with punkahs and other appliances to moderate excessive heat, furnished the greatest number of fatal cases.' Surgeon Longmore, of the nineteenth regiment, notes that one-third of his cases and nearly half the deaths occurred in one company of the regiment quartered in the barrack, which was manifestly the worst conditioned as to ventilation, and, indeed, in every sanitary requirement. M. Bassier, a surgeon in the French navy, reports that the man-of-war brig *Le Lynx*, cruising off Cadiz, in the month of August, had eighteen cases of insolation out of a crew of seventy-eight men. The heat was excessive (91° to 95°), and much aggravated by calms. The ship was overcrowded, offering little space for the berthing of the crew. M. Boudin quotes the case of the French man-of-war *Duquesne*, which, while at Rio de Janeiro, had a hundred cases of insolation, out of a crew of six hundred men.

Most of the men were attacked not when exposed to the direct heat of the sun, but at night when in the recumbent position—that is, when breathing not only a hot and suffocating, but also an impure air."

The works of Surgeon Joseph Wilson, U. S. N., 1870; Medical Directors T. J. Turner, 1879, and A. Gorgas, 1897, and Medical Inspector H. G. Beyer, 1908, include but passing references to heat affections.

Medical Inspector J. D. Gatewood, in his *Naval Hygiene*, 1909, writes:

"About 90 per cent. of all troubles ascribed to heat come from a part of the service—the engineer force in cruising ships serving under conditions that put a large load on the kidneys while depriving them of the fluid necessary to flush themselves properly. The result is a great concentration of irritating urine, and perhaps even anuria if, while the body is bathed in warm sweat, there is a sudden checking of perspiration and rapid chilling of bodies under ventilators or fans. . . . If during the year 1905 all the firemen and coal-passers had been at sea the entire time, there would have been about 200 admissions for heat troubles from each 1000 firemen and coal-passers so employed, and in the year 1899, about 400, *other conditions remaining the same.*

"The intensity has relation, however, to atmospheric conditions while underway and to the course of the ship in relation to wind, high outside temperature, with high relative humidity, and relative state of calm producing the maximum result. The hearts and kidneys and stamina of men, if much speed is maintained, are then greatly tried, especially if new men, some perhaps not well selected, are working as coal-passers. It would therefore seem that, in a general way, tropical cruising, especially in our summer months, and an increasing percentage of recruits in the engineer force tend to that condition in the service known as heat prostration. For instance, the records show that in 1898, when owing to the Spanish-American War there were relatively large number of recruits and several summer months of general tropical cruising, though chiefly at reduced speed, the admission ratio for cruising ships was 29.4. . . . At present the nature of the so-called heat prostrations in fire rooms is not well understood. It appears that when men are working in hot air they are able to perform their duties without much distress, when the standing of the wet bulb thermometer is not much above 81°, but when that bulb approaches 86° to 88° the disinclination to work becomes very marked. However, the form of heat prostration may not be due to the direct condition of contained air as shown by thermometer readings, but may be precipitated by rapid variations of skin temperature incident to exposure to drafts under ventilators in natural ventilation or to currents incident to assisted or forced drafts when applied to a

fire room already containing men who have been subjected to very high temperature.

"At any rate, it has seemed that the tendency to heat prostration has become quite marked at times just after assisted draft has been started. It may be considered that if fire rooms were kept under assisted draft the cases of heat cramps would be greatly diminished, but that the use of assisted draft only occasionally to meet special conditions may be responsible for a number of such cases at some particular time."

The air of fire rooms has probably always been of sufficient chemical purity so far as adequate oxygen and minimal carbon dioxide are concerned, and there is no evidence that carbon monoxide from the furnaces or coal oxidation on the floors has accumulated to produce any such toxic symptoms as are commonly attributed to heat. That this distress tending to heat prostration is a matter of heat and humidity preventing automatic cooling of the body by evaporation of sweat and by convection to circulating air, as shown last year by Mr. Leonard Hill, of London, was surmised years ago is indicated by the following extracts from sanitary reports:

Surgeon Geo. H. Cooke, reporting on the U. S. S. *Mohican*, in 1885, said:

"It was while cruising along the Mexican coast during the rainy season [July and August] and in the warm water and hot murky weather of that region that numerous cases of prostration from heat occurred, as well among the men on deck as with those in the fire room."

Surgeon John C. Wise, on the U. S. S. *Jamestown*, in 1886, said:

"Two deaths occurred during the year: one, a case of insolation happened when the thermometer stood at 85°, showing the importance of care in this respect, especially when there is great atmospheric humidity, which so often prevails in the West Indies."

There are probably few medical officers who would now fail to to affirm the belief of Chevers, Manson, Castellani, and other eminent authorities that of the predisposing causes of heat-stroke, alcohol habituation, or even occasional alcoholism, is one of the greatest factors. While I personally believe the navy would be almost infinitely better off if total abstinence could be enforced, and the medical department and messes of ships quite as well administered, if no spiritous, vinous, or malt liquors were permitted on board ship, still, given men who frequently indulge, that there is another side to the practical question is evidenced by the following opinions and practices of former naval surgeons: P. A. Surgeon G. P. Lumsden, reporting on the U. S. S. *Boston* en route from New York to Jamaica and Central America, October, 1888, says:

"The firemen complained of the heat of the fire room, which

had a temperature of 140°, and several cases of heat exhaustion occurred; the first on October 6th, the second day out from Sandy Hook. After this one ounce of whisky was given each fireman, who brought a card from the engineer at the end of his watch. This seemed to have a beneficial effect, as there were fewer complaints after this, and they appeared to work more cheerfully. At Port Royal fifteen gallons of Jamaica rum were purchased by order of the captain, upon the recommendation of the surgeon, which was served out in one-ounce doses as stated above, and it lasted until within a few days of New York."

Surgeon E. H. Green, on the U. S. S. *Marblehead*, reported in 1894:

"The temperature of this [berth] deck with the dynamo running was from 90° to 92°, rendering it almost impossible to obtain refreshing rest. The fire room has had a temperature as high as 140° [the author observed it 186°, July 13, 1906]. Usually it is 120°, the engine room being from 105° to 110°. There were several cases of heat exhaustion, though none of them of a serious nature. While cruising in the tropics it was found necessary to give stimulants at the end of each watch: one and one-half ounces of rum were given, and it had good effect, as it kept the men up to their work, looking forward to the dram at the end of the watch, and it restored the exhausted system materially."

Surgeon Howard E. Ames' report on the U. S. S. *Detroit*, for 1895, says:

"It is here I will make a few remarks upon the engineer's force, based upon observations made upon this vessel, and which, I think, apply to the whole service. The modern warship is a series of small compartments, demanded for strength and security. This compartment system is followed in the coal bunkers. When under steam in hot weather, these bunkers are not properly ventilated, and in addition to this the heat is too great. The deficiency of fresh air is not so serious a defect as the high temperature which surrounds the men while working. During the summer we were up the Yang-tse River, and during that trip the temperature of the coal bunkers ranged from 115° to 127°, while the outside temperature on deck was from 95° to 100°. If the engineer's force is expected to maintain its efficiency it is important that some scheme be devised to overcome this excessive temperature. It is absurd to expect nature to overcome a temperature of 28° under such conditions, and no human being can work efficiently in such a temperature without permanent injury to his physical and vital constitution. Take in addition to the heat, the *motionless*, impure air of the bunkers, filled with coal dust, constantly clogging the sweat glands of the men, and a moment's thought will picture their deplorable condition. During the trip it was only by giving each fireman and coal-passer two ounces of whisky at the end of

his four-hour watch that we were able to keep them at work and accomplish the trip. We had several cases of heat prostration, none of which was fatal. The men at the end of the watch were almost collapsed, *streaming with perspiration*, accompanied by *stertorous breathing*, *rapid pulse*, and trembling limbs. The eight hours' rest was not sufficient to restore them sufficiently to consider them efficient men.

"This exhaustion was not due to the work, but to the abnormal conditions surrounding the workers. This is shown by the weight of the coal handled on this trying trip. The general consumption during one day was 26 tons, the daily average for the trip being 18 tons. If we admit that this average was handled twice, it would give us but 36 tons handled in twenty-four hours by 30 coal-passers, or 1.2 tons per day per man, and this work was not continued beyond four hours. Such light physical exertion under normal conditions would scarcely be appreciated in its effect on the physical organization of a healthy laboring man. In this case we are forced to consider the degraded air and the heat as the cause. We can practically eliminate the degraded air of the bunkers by considering the amount of work done under similar conditions, but in a temperature below that of the body. We are forced to admit that it is principally due to excessive heat."

Extract from report on the U. S. S. *Bennington*, 1898, by P. A. Surgeon E. P. Stone:

"The men of of the engineer's force, all of whom swing in the wing passages and after berth deck, after four hours of severe and arduous toil in the frightful temperature of from 140° to 150°, would come off watch and endeavor unsuccessfully to get rest and sleep in the only comparatively less trying temperature of from 90° to 100°. Unable to sleep, worn out with fatigue, and annoyed by prickly heat, it would be jaded and discouraged men who would respond to the next call to go below on watch. Is it to be wondered at that the medical officer is called upon to furnish stimulants to keep these men up to their duty? Is it to be expected that men in such a condition can do efficient work? And may not a fire-room force in such a plight seriously cripple the fighting efficiency of a ship, as my predecessor has pointed out in his report? . . . It has been the custom on this ship to give, when under way, each watch in the fire and engine rooms some liquor, either during or at the end of the watch. On our way here from San Diego I conformed to the custom after the first few days, principally for its mental effect on the men, as they expected it, and furnishing the liquor served to keep them contented. I have not had enough practical experience yet to feel like making a positive statement, but so far as my experience goes it has inclined me to be opposed to the issue of spirits to men subjected to high temperatures. It produces a temporary stimulation, but leaves the men ultimately

in a state of lessened resistance. I believe a better stimulant, and a useful prophylactic, is the administration of strychnine. In those cases of heat prostration that give rise to muscular cramps, I believe, theoretically, that subcutaneous injections of normal salt solution ought to give relief."

Extract from report on the U. S. S. *Massachusetts*, 1899, by Surgeon S. H. Dickson:

"I had been led to expect, under the circumstances of war and during a close blockade and operations in the tropics of such duration in the summer months, that many cases of heat prostration among the 100 men of the engineer force would be encountered. With fires lit all the time, and steam all over the ship; bottled up, so to speak, every night, with temperatures in the fire rooms frequently and for hours at a time from 144° to 150°, in the engine room rarely below 120°, conditions were constantly favorable for their development; and yet but fourteen cases in all were admitted to the sick list, and these occurred after the removal of the strain and excitement of actual hostilities, and none of them of a serious character. Careful hygienic measures, such as frequent opportunities for bathing and washing, and the intelligent and constant use of the ventilating blowers, supplying an abundance of fresh air, undoubtedly led to this result. On only one occasion, and for a brief period during the voyage from Porto Rico to Cuba, was it considered necessary to issue a small spirit ration to the engineer division. It put heart into the men and was productive of nothing but good. It was given to each watch on coming off duty and after they had washed and cooled off."

Extract from report on the U. S. S. *Columbia*, 1899, by Surgeon C. G. Herndon:

"A number of men at various times were more or less overcome by heat in the dynamo, engine, and fire rooms, and were promptly brought to the sick quarters. The heart and not the brain was the organ which had given out among these men. The routine practice was to stretch the man out on the cofferdam, with the head low, loosen all tight clothing, and give him a liberal dose of whisky or brandy, with digitalis. Usually in a short time he would go off into a quiet sleep, and wake up ready for work.

"I am opposed to the routine issue of alcohol to the men below while on watch; but from my experience, and more particularily on this ship, I believe it would be well, if the Bureau sees fit to do so, to increase the amount of whisky in the medical supplies and allow the medical officers to give it to deserving men coming off watch when they show markedly the effects of the long exposure to the high temperature in which they work.

"I have seen various stimulants used, but nothing, in my experience and belief, does these men as much good when coming off

watch as a ration of whisky diluted with water, and, if necessary, with some digitalis added."

Surgeon M. H. Simons, on the U. S. S. *Iowa*, 1899, reported:

"During the trip to San Juan, and on one or two other occasions when the heat was great, the men in the engine and fire rooms drank so much warm water that nausea and vomiting often occurred, and nothing would be retained. We found that under these circumstances the trouble could be checked and even avoided by a moderate dose of alcoholic stimulant (part of the time we used alcohol itself), with capsicum, gentian, or hydrastis. This dose seemed to put the stomach in proper tone for the digestion of food, and to lessen the thirst. As a preventive it was given when the men came off watch. Heat prostration was treated by putting the man in a bunk with a wet towel over his face and head and giving 0.6 gram of acetanilid; in one hour, if the temperature still stood above 100°, 0.3 gram was given until the temperature stood below 100°, and then a bath was given, in which the patient lay for fifteen minutes; the water was at first warm and then gradually cooled to the temperature of the sea water in the pipes, probably about 76°. The acetanilid equalized the circulation and subdued the nervous symptoms; the lukewarm bath seemed to aid this and to exert a specially and noticeably good effect on the digestive tract."

In discussing "The Alcohol Question in the Navy," Medical Director P. A. Lovering, who was surgeon of the U. S. S. *Oregon* during the Spanish-American War, stated:

"I remember that on the cruise of the Oregon around from San Francisco, Captain Clark every day at his own expense furnished the firemen coming off the afternoon watch with a drink of spirits. It encouraged the men, did good, and I was glad that I could recommend it as a beneficial measure."

From our more recent knowledge of the precise nature of the action of alcohol in small doses it seems evident that the benefits noted in the foregoing reports were psychical and doubtless attributable to the narcotic effect; alcohol in these cases probably induced a more comfortable frame of mind, indicating consideration upon the part of officers in authority, and withal favored relaxation akin to that sometimes given after disease or injury to relieve undue apprehension. It is significant that no naval reports of the last decade refer to the use of alcohol either in prophylaxis or treatment.

With reference to the well-known advantage of having ships painted with light reflecting surface, Medical Inspector T. C. Walton, reporting on the U. S. S. *Chicago*, in 1899, says:

"Changing the color of the outside of the ship from black to white is believed to have lowered the temperature on this [gun] deck, during the summer days when the sun shone on the ship's sides, from 4° to 6°. . . . During the speed trials of this

ship at Newport in September last the temperature in those parts of the engine rooms was recorded as high as 129°. The air at the time was laden with moisture from escaping steam. A prolonged stay there was described as being unbearable. The engineers on duty were quickly prostrated. Efficient ventilation was urged."

Inadequate ventilation and removal of heated air on the earlier all-steam propelled ships is attested by the following quotations:

Medical Inspector G. W. Woods reported on the U. S. S. *Charleston* in 1890:

"The heat of the dynamo room is often so great that the thermometers, indexed for 140°, cannot register the temperature, and the men perform their work entirely naked, complaining of nausea and vertigo whenever the revolutions of the little electric blower are even for a brief period suspended."

Surgeon T. H. Streets reported on the U. S. S. *Bennington* in 1893:

"The temperature of the fire room previous to these changes [new hatch opened and new ventilators] was frequently as high as from 140° to 150°. The temperature has been materially reduced. The highest it has reached since the opening of the hatch is 112°."

On the U. S. S. *New York* January 11, 1894, Medical Inspector Edward Kershner found the temperature of living and working spaces to range from 88° to 108° throughout the ship when the outside air registered 82°, although the trade winds blew at the rate of 6 knots on the port bow, the ship making 13 knots under but four boilers, and burning but eighty-five tons of coal per day.

Likewise in 1894 Surgeon W. G. Farwell reported on the U. S. S. *Columbia:*

"The temperature of the engine and fire rooms is excessive when firing hard; the temperature of the fire room ranges from 140° to 150°, and that of the engine room from 105° to 110°; when firing immediately the temperature is respectively from 120° to 125° and from 98° to 100°. . . . the temperature of the cabins opposite (the engine room hatches) was 90°, an almost unbearable degree of heat for a sleeping room."

The recording of excessively high temperatures was the rule rather than the exception for a few years prior to and immediately following the Spanish-American War of 1898.

Surgeon C. A. Siegfried reported on the U. S. S. *Cincinnati* in 1894:

"In the dynamo rooms by means of electric (additional) blowers the temperatures have been reduced 20°, and they now rarely rise above 110°. . . . The ventilation of the engine room is very unsatisfactory, and temperatures are recorded from 90° to 170°. . . . I have myself recorded fire-room temperatures as high as 168°. In the engine room, lower platform, the

average is about 102°, on the upper platform it frequently reaches 135°."

Surgeon E. Z. Derr, on the U. S. S. *Raleigh* in 1894 and 1895, reported:

"The inadequacy of fire-room ventilation made itself manifest on the first trial trip to Hampton Roads. Steaming half power the temperature of the starboard forward fire room in the boiler interspace, five feet above the floor, reached 180°. Three men were exhausted by the heat. On September 10, steaming under the same easy conditions, it reached the same, and two men were exhausted. On September 11, 190° was recorded. On the fire-room galleries, where the blowers were located, the thermometer registered 205°, rendering it impossible for the men to superintend them, and accordingly they were not used. The fire rooms were therefore dependent upon natural ventilation alone, and that supplied by the ventilation was wholly inadequate to keep down the temperature."

Medical Inspector J. G. Ayres, on the U. S. S. *Olympia* in 1895, reported temperatures of 180° and above in two of the fire rooms which had no blowers.

Surgeon C. A. Siegfried, again in 1895, on the U. S. S. *Texas*, said:

"It is to me doubtful if any possible system of ventilation in some of these spaces would correct the high temperature ranging from 125° in dynamo rooms and redoubt to 170° in hydraulic pump rooms. When the ship is under way the heat becomes excessive and during the short periods of time when making steam trials last September the number of cases of heat exhaustion treated in one day, aggregated twelve. The hydraulic rooms furnished most victims, hence the more thorough covering of the hot metals, pipes, etc., with non-conducting materials becomes imperative."

The improvement made on the U. S. S. *Cincinnati* in 1895 is shown by the report of Surgeon L. B. Baldwin, in which he showed average temperatures of fire room No. 1 to be 143°, 188°, 187°, 184°, 189°, 191°, and 109°, with a maximum of 204° between June 30 and May 12. After some changes in the management of the blowers the average temperature was reduced to 126° and 139°, with a maximum of 170°. The average for the year in this fire room was 145.8°.

The Surgeon General's report of 1897, covering the year 1896, stated:

"Of the 59 cases of heat-stroke, 40 were caused by heat in fire and engine rooms, 7 of the latter being returned from the *Raleigh*, 5 from the *Indiana*, 4 each from the *Amphitrite* and *Massachusetts*, 3 from the *Maine*, *Newark*, and *San Francisco*, and 2 each from

the *Cincinnati, Alert,* and *Marion,* the remainder (5) occurring scattered, 1 on each ship."

Surgeon Robert Whiting, on the U. S. S. *Monterey* in 1895, reported:

"The continued strain of resisting the high degree of heat early began to tell upon the men of the engineers' force. The closed fire room of the *Monterey* has no outlet overhead, the doors opening on one side into the overheated engine room and on the other into the berth deck. The forced draft ventilation not being in use, it was discovered that the fire room was fed by hot air from the engines on one side and on the other by air that had been devitalized by use on the berth deck. The medical officer upon one of his inspections found the temperature as high as 147°. There were a number of cases of exhaustion and vomiting, most of which were treated without entry upon the sick list.

"The drills at general quarters, which were more frequently performed than any others, required the use of steam in the pump rooms underneath the ward-room officers' quarters and under the berth deck. It will be observed by reference to the temperature charts that these pump rooms registered the highest degree of heat, 180°. It required hours to bring the atmosphere in the ward-room down to 90° after these drills were concluded. The dynamo room, contiguous to the forward turret and underneath which the forward pump room is located, the main compartment of the berth deck separated from it by a steel bulkhead, suffered in similar fashion."

Surgeon James E. Gardiner's report on the U. S. S. *Amphitrite* in 1896, stated:

"So far the most serious trouble developed has been the one of the high temperature generated on the modern iron and steel ship filled with engines and imperfect means of ventilation so far devised to relieve the evil. From the records of the medical journal the suffering from this cause while the ship was cruising during the months of July and August was great. Temperatures as high as 183°, in the fire room are recorded, with 167°, given as the minimum during the twenty-four hours of that day. In the engine room for the same day are recorded 155° as maximum and 148° as minimum; the berth deck, 102° maximum; a state room in ward room, 98°. There were numerous cases of heat prostration, cases of myalgia, cramps, and sudden diarrheas. A board appointed by the commanding officer, after carefully collecting the data, made its report, and the ship was ordered to the navy yard at Norfolk, where the changes were made. Since then the conditions have greatly improved. No test as severe though as that of last summer's cruising has been made since the change, but it is believed that no such temperatures will again be reached."

Extensive temperature observations made by Medical Inspector

J. G. Ayres in the dynamo room of the U. S. S. *Olympia* in 1896 gave the maximum as 121° and mean as 113° for August and 113° and 105° for October. In the same year the dynamo room of the U. S. S. *Columbia* was found to have a temperature range from 110° to 125°, and the steam-steering room exceeded 120°, with defective ventilation.

The means for adequately heating certain living spaces in ships often proved intolerable to other compartments as is shown by Surgeon W. S. Dixon's comment on his own state room on the U. S. S. *Brooklyn* in 1897:

"No less than seventy-five feet of steam pipe (heating) are very close to the berth—some of it within two inches and none of it more distant than forty inches. Five pipes pass through the room, and four are separated from it only by a thin metal bulkhead. Until the five pipes (forty-five feet) had been additionally covered with felt, one could not sleep in the bunk. With an outside temperature of 19°, that of this room was 90°, as determined by reliable thermometers, and the air duct was delivering cold air in the room at the time. In one of the double berth rooms of the junior officers two thinly covered steam pipes pass along the whole length of the upper berth, and in such close proximity that a man of ordinary proportions could scarcely crowd in between the mattress and pipes. It would be impossible for anyone to sleep there while steam was being used to heat the ship."

Surgeon W. R. Du Bose reported from the U. S. S. *Terror* in 1897:

"Practically the ship has done no cruising, and exactly what temperatures will be experienced remains to be seen. In the short trips made the engine-room temperature has been 118°, the fire room 116° to 142°, generally 122°; the forward turret machinery space, 124°. In the superstructure during a heated term in July and August a temperature of 110° was several times noted. No case of heat exhaustion has occurred."

Surgeon P. A. Lovering, on the U. S. S. *Oregon* in 1897, reported:

"The berth deck is also very warm, as it is over the main boilers, and in it is placed the auxillary fire room. When the vessel is underway the temperature often rises to 100° and even higher, and rarely falls below 85°. The forward compartment of the citadel is fairly lighted by twelve deck lights, but has no direct air supply. It is much cooler than the central compartments, as it is forward of the boilers.

"Each engine room has, besides the usual hatch, a blower for artificial ventilation. The temperature ranges between 90° and 100° when under way.

"Each of the eight fire rooms has a large ventilator, and also a blower for forced draft, which is used for ventilation. When under way the temperature has reached 135°, but is usually 5° to 10° lower. This temperature was in cool weather when the outside

air was 60° or less, and it is probable that in warmer weather the fire rooms will be much hotter.

"There have been no cases of heat prostration."

The protests of some of our medical officers during this period were almost pathetic, as is seen in the following extract from the report on the U. S. S. *Bennington*, in 1898, by Surgeon John W. Baker:

"We should build our ventilators larger and higher and make them more numerous; provide our fire rooms, bunkers, and engine rooms with fans on a large scale, until we no longer are content that men should, in these days of modern science, toil and labor in a vitiated atmosphere at a temperature varying from 130° to 170°, until they are temporarily exhausted or permanently disabled, and that, too, long before the period assigned to men who live on deck in fresh air and wholesome sunshine, and who are never called upon to make the physical exertion, save in unusual emergencies, that these men must make every day, if we would maintain our speed at sea, speed and turning in evolutions—in fact, the efficiency that is not only desirable but absolutely essential for our success in warfare, and for which our ships are constructed."

Surgeon M. H. Simons, reporting on the U. S. S. *Iowa*, in 1899, stated:

"The ventilation of the distiller room is entirely inadequate, and the temperature is so high (145°) frequently that the man neglects his watch on the gauge to stand under the small cool-air inlet. The exit shafts for hot air in the dynamo room are so small that half the hot air collects in one or the other ammunition passage, increasing greatly the discomforts of those who must work there, especially in battle. The temperature of the dynamo room varies from 107° to 125°. . . .

"The state rooms for the officers in the citadel, at sea, in warm weather, have a temperature range of from 93° to 100°, artificial light has to be used all the time."

Surgeon John M. Steele, on the U. S. S. *Monadnock*, in 1899, reported:

"On entering the tropical zone, where the temperature of the air and water are nearly the same, and high, about 84°, the vessel heated up rapidly and remained so.

"The hottest part of the vessel in which men live is the superstructure and warrant officers' quarters. The warrant officers' quarters are next to the dynamo room, and separated by an iron bulkhead, and in the forward room the temperature averages about 95°. In the superstructure is situated the cabin and ward room, officers' quarters, also the galley, the officers' water closets, and the mens' head. These apartments are directly over the fire and engine rooms, and the heat here is high and continuous night and day, with an average of about 94°. There is a slight remission in the early morning hours. In addition to hatches, deck lights,

and air ports the present means of ventilation should apply to the superstructure, and an active method of introducing fresh air, which could be accomplished by two additional blowers, to force air into the entire vessel. This addition would combine the plenum and exhaust, which I believe is necessary for the best effect for the health of the crew."

From a better ventilated gunboat, the *Annapolis*, in 1898, Assistant Surgeon S. B. Palmer reported:

"No excessively high temperatures have been noted in the engine and fire rooms, the two cases of heat exhaustion of mild grade which were treated were men unaccustomed to this work."

Asbestos sheathing helped to alleviate suffering in the living quarters abaft the engine room trunk of the U. S. S. *New York*, in October, 1899, where the temperature had formerly ranged from 98° to 110°. Medical Inspector C. U. Gravatt urgently advocated similar insulation in the dynamo room and evaporating room.

All evaporators are nowadays well covered with asbestos, conserving heat for their more economical operation and promoting comfort for their tending.

The surgeon of the "Flying Squadron," Medical Inspector Paul Fitzsimons, for 1898, stated:

"The fleet blockaded Santiago for five weeks, lying off the entrance about two miles in the open sea. Fortunately the trade winds were usually fresh, and no one suffered from the heat on the main and gun decks. The berth deck was like an oven. It was heated on the outside by the sun and inside by three smokestacks, the battle ports were closed and a moderate amount of air was driven by the blowers. The warrant officers' rooms were uninhabitable. The awnings could not be spread, and after a time the men were permitted to sleep in the open instead of sweltering below. They would lie on the forecastle wrapped in blankets, and no case of sickness was caused by it. The crew also worked in the sun coaling ship frequently without injury."

Since the Spanish-American War conditions have steadily improved and the unfavorable reports have come chiefly from the older armored ships, notably the *Monadnock*, *Massachusetts* (in the fire rooms of which Surgeon J. C. Byrnes reported in 1900 an occasional temperature of 210°, reduced 30° by changing location of blowers), *Monterey*, *Chicago*, *Iowa*, *Brooklyn*, *Illinois*, *Wisconsin*, *Albany*, *Oregon*, *Alabama*, *Newark*, *Kentucky*, *Colorado*, *Ohio*, and *West Virginia*. Many reports at hand from these sixteen vessels, while interesting, merely reiterate the high temperatures of the living and working quarters.

On the U. S. S. *Texas*, Surgeon H. E. Ames reported steering engine room temperatures of 110° to 115° and humidity "so great that there is no evaporation from the body . . . those of the crew who are stationed there at sea are exhausted at the end

of two hours. "The firemens' wash rooms were "from 130° to 145°," and of course the air was saturated with moisture. Fire-room temperature under natural draft was 150°.

From the U. S. S. *Wisconsin,* in 1906, Medical Inspector H. G. Beyer reported as follows:

"Battleships and monitors will always be the most uncomfortable ships in a climate such as this (Cavite). With perfect sanitary conditions the constant high temperature and humidity from within and without are bound to cause a steady lowering of the average physical and mental strength and endurance of every human being on board. This generally acknowledged fact makes frequent change of station, especially for battleships, not only desirable but imperative.

"During the passage of this vessel from Hongkong to Cavite, between December 28 and 30, 1905, a series of heat prostrations occurred. Of the 14 cases, 10 were firemen, 2 water-tenders, and 2 coal-passers. The symptoms varied but slightly in the different cases, and were chiefly those of collapse, with dizziness, headache, and severe cramps in the legs, thighs, arms, forearms, back, and abdomen. In no case was there embarrassment of speech, although loss of voice was noted in one fireman, who stated that this was his second attack. Two of the cases did not show distinct symptoms of heat prostration until some little time after leaving the fire room, and one of the two was found unconscious.

"These patients were at first rubbed with towels soaked in hot water, with excellent results. Some in whom the cramps were painful and distressing were rubbed with chloroform liniment. Rest, of course, was enjoined upon them, and all were off the list and on duty two days after the arrival of the ship in port.

"The direct cause of the outbreak was the heat in the fire room, from what is known as assisted draft. In assisted draft the fire room is made as tight as possible, the air inlets and the furnace outlets being the only places in open communication with the fire room. But, unlike what happens during forced draft, when the blowers have their speed increased, and the incoming volume of air is very much greater than under ordinary draft, in assisted draft the incoming current remains the same, or may even be reduced.

"Several points in connection with the occurrence of this interesting series of heat prostrations seem to be unusual. The temperature in the fire room was not excessive, and alone could scarcely account for so widespread an effect; the relative humidity of the atmosphere was very high, and the temperature and moisture of the atmosphere suddenly increased the day the prostrations occurred. The afternoon we left Hongkong officers and men wore blue with comfort; the next morning white was ordered because of the sudden climatic change."

Of the smaller cruisers and gunboats complaints of high tem-

peratures and humidity were made in reports from the *Petrel* (160°), *Isla de Luzon* (172°), *Albany* (136°), and *Princeton* (115°).

On the newly commissioned U. S. S. *Maine*, in 1903, Surgeon N. H. Drake recorded 45 cases of heat prostration:

"Fifteen admissions to the sick list for this condition and about thirty others were treated for vertigo and cramps in the muscles of abdomen and limbs. Only one of those admitted remained on the sick list more than two days, he being under treatment for five days. Many of those not admitted were excused for the whole or a portion of their watch below. This unusual number of cases was attributed to a combination of circumstances, viz., new men unfit for service in their ratings; varying temperatures caused by draughts and blowers; improper clothing of the men in the fire room; the use of too much cold water while on watch; drinking water unfit for use on account of chlorides, and extremely hard work in a climate to which many of them were unaccustomed."

Assistant Surgeon A. G. Grunwell, who later evolved the interesting theory that heat cramps might be occasioned by absorption of toxins of tetanus bacilli from intestinal contents, in 1900 treated heat stroke successfully by venesection in the walled city of Tientsin during the Boxer uprising.

The following extracts from the annual report of the Surgeon General of the Navy of 1909 show how recently heat affections seemed to deserve special attention.

"Heat exhaustion is less prevalent than it was two or three years ago for the reason that the small cruisers with poorly ventilated fire rooms have either been withdrawn from tropical service or placed out of commission. The opinion that heavy, muscular work has been a contributory essential, and that heat, humidity, and rapid cooling of the body are not the only causes, received some support from an observation of Passed Assistant Surgeon G. H. Hathaway, on the U. S. S. *Cheyenne*, which now burns oil fuel. This officer shows that 'during the standardization runs at maximum speed the termperature in the fire room rose to 140°, which is about 10° higher than under previous similar conditions when burning coal. Nevertheless, in this higher temperature no case of heat prostration occurred, nor during the cruise has any member of the engineer's force succumbed to the heat. It is thought that the slight amount of physical exertion required to regulate the burners, as compared to passing coal, enables the fire room watch to withstand a greater elevation of temperature. While cruising the number of men on duty in the fire room is reduced to about one-half those required for coal fuel, which is of some sanitary advantage.' . . . Just what factors enter into the causation of the condition known as 'heat prostration' observed in those exposed to excessive heat, either solar or artificial, particularly fire room, is not definitely known today. There have been a great many cases in the navy during past years, and though

in 1908 a fewer number than usual were reported, and although effort has been made and is being made to improve the condition under which the engineer's force performs its duties, there seems no immediate prospect that the condition will cease to be an important type of disability."

Although not occurring on shipboard it would be amiss not to include in these extensive quotations the cases mentioned in an extract from the report of Surgeon G. A. Lung on duty with the First Regiment of Marines in the Pekin Relief Expedition of 1900:

"Two types of heat stroke were observed. The more common one was exhibited with extreme fatigue, mental depression, weak circulation, with perhaps partial loss of consciousness. The other appeared more suddenly, and was marked by hard, fast pulse, suffused face, bloodshot eyes, complete unconsciousness, and perhaps delirium, with muscular spasms of the entire body. These cases would appear while the column was moving or immediately on coming to a rest. If on the march they would stumble and fall in the roadway, or while sitting would suddenly topple over. The first intimation the medical officer would have would be the cry with stentorian insistence for the doctor, and on some days it came with startling frequency. They were carried to one side, an imperfect shelter from the sun for the head made by bending several standing cornstalks together and the best remedies at hand applied. If the patient appeared seriously ill a man was left with him, or several thus affected would be gathered together and one man look after all. In the meantime the column would move on, leaving them behind. The number who had convulsions was comparatively small. A large percentage became unconscious.

"August 10, was a peculiarly trying day, because of the heat. By noon fully seventy-five of the regiment had dropped out. It is true some of these were only badly wearied, and found an example in those who were more than wearied. There was, however, no shirking or malingering. Every man seemed to realize the character of the expedition and the purpose for which it was made. Indeed, it was sometimes touching to see a man with a determined expression trudging along, staggering from weakness and the weight of his accoutrements, and with a degree of illness that entitled him to a bed in a hospital. A few of the men, instead of dropping out at once, would gradually drop to the rear, where they would totter along, crying like a lost child, until relieved of their burden by a companion or forced to lie down and rest.

"A most remarkable feature of these cases of heat-stroke was the rapidity with which they recovered. Often without any treatment whatever, and by night, all by helping one another, or by getting a lift in a wagon or a ride on a horse, would overtake the column encamped for the night. The following day they would take their places in the ranks again. If the expedition happened

to be near the river and junks were available the worst cases were sent on them for a day's rest.

"There were but two deaths from this cause, one occurring at the battle of Yangsung, and the other at Tungchow. Two were afflicted with mild melancholia, but after a short rest in the hospital they recovered."

Undoubtedly the most complete report on heat cramps by medical officers of the navy in recent years are those of Surgeon M. S. Elliott in the *Military Surgeon*, for March, 1908, and of Surgeon A. G. Grunwell in the *United States Naval Medical Bulletin*, for July, 1909; their clinical notes are too extensive to be quoted here and from the one autopsy by Elliott the only characteristic pathologic condition found was congestion of the kidneys.

Sun-stroke as typically occurring in the midsummer heat of our cities is now comparatively rare in the navy, the last published case being one observed by me off Acajutla, Salvador, in 1907, in the person of a boat-keeper of the U. S. S. *Marblehead*, who fell asleep and became unconscious in his boat, without awning cover, and experienced total amnesia for sixty-nine hours. Thermic fever does not appear to have been an important factor since the Spanish-American War, when 89 cases were recorded. During the twenty-five years from 1886 to 1910 inclusive there were returned 1507 heat cases, of which 64 per cent. were heat prostration (commonly of the exhaustion type), 32 per cent. were classified as thermic fever, and 4 per cent. as insolation. About one-third of the cases of thermic fever developed on shore, and doubtless the larger part of the few on board ship were ill-defined confusion cases.

So far as I can learn heat-stroke between decks among men not performing hard work is unknown in our navy; if it were now common for persons to be stricken in cabins or while asleep we should certainly look for the condition among our ten thousand man-o'-warsmen here about Key West and Cuba during the midsummer.

From the recorded and personally received opinions of naval medical officers I feel justified in affirming that the characteristic heat affection of the naval personnel has during the past quarter century been "prostratio thermica," heat exhaustion, largely confined to the fire room force; during 1909 and 1910 respectively, the admission rates per thousand for heat affection in the fire-room force were 8.45 and 7.91 respectively, while for the entire service they were 2.79 and 2.16 respectively, every other occupational group having ratios below the mean with the exception of the engineers' force, which were 3.26 and 2.78 for the respective years. This most common form, heat exhaustion, is believed to be a disease entity with either the systemic or muscular symptoms predominating, sometimes the one form almost to the exclusion of the other. The heat regulation centres do not appear to be so profoundly

incapacitated as in sun-stroke, there being but slight fever or very commonly the subnormal temperature of shock; Marine Oberassistenzarzt Dr. Esch, however, considered his case chiefly one of deranged nerve centres.

There is pallor or lividity, drenching perspiration, weakness of both voluntary and involuntary muscles, the circulatory and respiratory functions being profoundly embarrassed. Sensory motor phenomena are those of exhaustion rather than of the irritable, responsive to the least stimulation, type—there is the tendency to sleep and stupor rather than to convulsions. Now, although parodoxical, it is no inconsistency that the other notable symptoms may become prominent such as fibrillary twitchings and violent painful cramps of muscles of the abdomen, arms, and legs; these can hardly be due to any systemic nerve poison, but must be consequent upon a local dehydration of muscle tissue, with a diminished alkalinity of plasma from excessive production and retention of katabolic acids (sarcolactic, carbonic, and lactic), which have been shown by McDougall and E. B. Meigs to attend muscle rigor; the accumulation of products of tissue metabolism generally may account for vasomotor paresis and shock. It is, of course, important to distinguish cases of intestinal cramps due to dietetic error or ice water ingestion from the heat cramps of abdominal wall muscles.

The etiology and incipiency of heat exhaustion need not be at variance with those of sun stroke except in intensity; the assumption is tenable that in sun stroke the factors are so fulminating and of such an overwhelming character that heat production and loss are promptly deranged, whereas the symptoms of heat exhaustion represent the sustaining and finally, failing efforts upon the part of the human body to overcome its adverse environment. I shall be content to enumerate these factors in causation of heat exhaustion, no one of which has been certainly eliminated as either contributory or immediate; no special combination seems to be essentially determining: Chronic alcoholism with fatty infiltration of the heart—dilatation when called upon to pump more blood through lungs and skin under stimulation of excessive heat; dissipation or debility from disease or unsuitable hygiene, such as overcrowding; hard muscular work (Edsall) and unrelieved fatigue; insufficient circulation of air and wet-bulb temperature from 85° to 95° (J. S. Haldane's critical point and Harvey Sutton's vicious circle); lack of habituation; constricting or heavy clothing; fright or panic induced by occurrence of other cases, as shown by Oswald Rees, R. N.; loss of sleep (H. M. Welch); improper nutritive ratio—excess of protein and deficiency of carbohydrates; insufficient assimilation of water; to these may be added Senftlenben's observation of blood concentration, red-corpuscle destruction and hemoglobinemia more commonly expected in sun-stroke; arterial anemia, toxin and fibrin ferment accumulation from preponderance of skin over kidney excretion and leukocyte destruction (Maurice

de Fleury); predisposition by former attacks (W. H. Cameron and Logan Clendening); the actinic theory of Lieut. Col. R. J. S. Simpson is merely mentioned to be excluded in our cases among the fire-room force.

For the physiologist no doubt the inclusion of so many causative factors, direct or remote, is unsatisfactory, confusing, and a confession of ignorance; for the hygienist their probable relation has given such hints that the removal of few or many has contributed to the great decline in heat exhaustion and cramps in the navy. If I were called upon to single out any one remedy to bring about this result more than another it would be the increased circulation of air where the men work rather than any mere lowering of temperature or humidity.

STATISTICAL TABLE OF HEAT AFFECTIONS IN THE UNITED STATES NAVY AND MARINE CORPS, 1861–1911.

Year.	Mean strength (medical returns).	Cases.	To hospital.	Invalided from service.	Deaths.	Number of sick days.	Total damage in percentage of sick.
1861	20,000	5					
1862	25,905	34					
1863	40,000	16					
1864	43,787	27					
1865	32,641	3			1		
1866 to 1872	17,193 to 11,570	No data available in published reports				Apparently all insolation.	
1873	12,723	14					
1874	13,870	19					
1875	10,141	5			1		
1876	11,138	8					
1877	7,461	17	"Heat exhaustion" (2 cases); first mentioned on Asiatic station.				
1878	7,806	10	..	..	..	26	.000791
1879	8,869	Not mentioned in reports.				..	.000000
1880	9,003	23	..	5	..	89	.026668
1881	9,546	18	3	1	..	50	.005729
1882	9,371	12	1	..	..	61	.001576
1883	9,197	10	1	1	..	166	.009670
1884	9,959	18	..	..	..	72	.001797
		"Heat exhaustion" really begins.					
1885	9,191	20	1	..	..	103	.003070
1886	9,188	5	..	..	1	20	.005442
1887	9,618	41	1	..	..	226	.006438
1888	9,955	25	..	..	1	96	.007657
1889	11,219	33	3	..	..	216	.005275
1890	11,768	37	..	..	..	257	.005983
1891	11,501	41	3	..	..	195	.004645
1892	11,775	29	2	..	1	135	.007760
1893	12,109	51	1	1	..	293	.010758
1894	12,520	44	..	..	2	190	.012145
1895	12,671	92	..	..	1	359	.011562
1896	13,768	59	3	..	1	257	.008622
1897	15,229	81	4	..	1	339	.010356
1898	23,038	512	19	7	..	2054	.039019
1899	20,113	154	10	1	1	939	.017594
1900	22,977	128	13	..	5	442	.015798
1901	26,101	95	4	2	1	643	.012352
1902	30,249	95	5	1	1	503	.007757
1903	36,534	94	2	1	2	333	.006543
1904	39,450	92	13	..	..	569	.003941
1905	39,620	160	3	..	..	655	.004529
1906	41,690	168	15	3	1	739	.009559
1907	44,083	86	4	4	..	504	.007448
1908	50,984	106	17	1	..	801	.005220
1909	55,550	155	6	3	..	703	.006090
1910	56,721	125	..	1	..	391	.002755
1911	61,399	88	..	1	1	423	.003516

REVIEWS

A Practical Treatise on Fractures and Dislocations. By Lewis A. Stimson, B.A., M.D., LL.D. (Yale), Professor of Surgery in Cornell University Medical College, New York; Consulting Surgeon to the New York, Bellevue, St. John's and Christ Hospitals; Corresponding Member of the Société de Chirurgie of Pairs. Seventh edition, revised and enlarged. Pp. 930; 498 illustrations. New York and Philadelphia: Lea & Febiger, 1912.

As a worthy successor to Malgaigne, Hamilton, and Gurlt, Stimson's monograph has long been the standard work on fractures and dislocations. It has now reached the dignity of a seventh edition. More than a hundred new illustrations have been added, and though in this way, as well as by numerous additions to the text, the number of pages has been increased by about eighty, yet the bulk of the volume has been skilfully reduced.

The book is too well known to require extended analysis, but a few references to matters of current discussion may be pardoned.

Dr. Stimson does not advocate operative reduction or direct fixation of fractures. He says: "The cases of fracture of the shaft of a long bone in which sufficient reduction cannot be maintained by a suitable external dressing are very rare. The cases are more frequent in which it cannot be completely made, or in which it cannot be certainly maintained during the application of the dressing. To make complete reduction exposure of the seat of fracture may be necessary, and in some fractures thus exposed and in some compound ones temporary direct fixation of the fragments may be advisable." He still maintains "that the presence of a foreign body, even if sterile and unconnected with suppuration in bone at or near the line of fracture notably exaggerates and prolongs the preliminary rarefaction of bone. I believe this influence may even cause failure of union . . . ." He believes silk and silkworm gut are less injurious than wire, and has no good words for Lane's steel plates. To Lane's claim that this absorption of bone does not take place if the fixation is solid, and the operation is done with minute attention to detail, Stimson replies, "That may be so. I do not know; but the evidence is overwhelming that, as currently applied, a wire or nail passing across the line of fracture does have this effect;" and he concludes that it is "unquestionable that the results of the general use of Mr. Lane's method would not materially differ from those

heretofore obtained by other fixation methods, and it is therefore by the results of those other methods, and not by Mr. Lane's, that the propriety of open fixation is to be judged."

In fractures of the neck of the femur he is satisfied with the reduction secured by that amount of abduction which is produced by longitudinal traction, with the slight tilting of the pelvis which is its consequence. Wide abduction, to secure forcible reduction, he condemns. He says: "No abduction which is wider than a normal neck will permit can create a normal neck. The alleged use of contact between the top of the great trochanter and the ilium as a fulcrum for such abduction is fanciful; no dissected hip that I have examined would permit the trochanter to be brought within an inch of such contact while the head remained in its socket." He adds: "Outward traction upon the upper part of the thigh, by weight and pulley, and a band passing about the inner side of the thigh, has been occasionally employed. I doubt both its efficiency and its advisability if efficient."

He adheres to the pathogenetical classification of fractures about the ankle-joint, the two main types being those by eversion and those by inversion. Of late objections have been made to this classification because not only are the patients frequently unable to describe how their injury was received, but also because it is claimed that similar accidents produce dissimilar lesions. Destot, Quénu, Clermont, and other recent students of the subject base their classifications on the lesions discovered by the *x*-rays, and disregard the pathogenesis. But though scientific accuracy may be on their side, Stimson's method undoubtedly has the merit of didactic simplicity. "The essential lesion," says Stimson, "is the tibiofibular diastasis." And of all the other proposed classifications we believe that proposed by Clermont, which has this lesion as its cornerstone, is the most accurate.

So much of interest is found in the portion of the work devoted to fractures, that it sometimes is forgotten that the section on dislocations is equally valuable and instructive. The most important additions in the present edition relate to the treatment of old dislocations; but of these we have left ourselves no room to write.

Throughout the work is painstaking, systematic, encyclopædic, and lucid—in a word, a model text-book. It is the best work of its kind in existence. A. P. C. A.

THE SURGICAL CLINICS OF JOHN B. MURPHY, M.D., AT MERCY HOSPITAL, CHICAGO. Vol I, Nos. 5 and 6, October and December. Philadelphia and London: W. B. Saunders Co., 1912.

THE October and December numbers of *Murphy's Clinics* conclude the first volume of this remarkable publication, notices

of which have appeared from time to time in the pages of this JOURNAL. The entire six numbers make a volume of 931 pages, with 165 illustrations, almost all of which are "inserts."

The exact relationship which Dr. Murphy bears to this periodical magazine never has been clearly defined. It appeared from the publishers' original announcements that his part was wholly passive, if such a word be allowable in describing so active and energetic a person as Dr. Murphy. What we mean to imply is that it appeared as if the enterprising publishers had sent their stenographer to attend these clinics, much as any other interested listener might attend, but of course with the avowed purpose of making notes for publication; and that of course this was done with Dr. Murphy's consent. Here, however, it appeared that Dr. Murphy's activity ceased. Certainly the first few numbers did not belie this supposition. They contained some startling and unsupported statements, many of them evidently uttered in the heat of argumentative reasoning; and the proofs seemed to have been read by no one who had any familiarity with surgery as an art or with its vast literature. These defects, for as such we regarded them, were dwelt upon in our previous reviews; and we are happy to say that (whether as a consequence or not) the later numbers, especially those now before us, show that at any rate some measure of editorial supervision has been exercised, though not yet are we allowed to know who the editor is. The early numbers caused considerable surprise, first that so accomplished a surgeon as Dr. Murphy should be willing to have his name attached to them in their unedited state, and second that he should ever have consented to an arrangement which put him in the position of having his teachings brought forth in seemingly unauthorized form. It was this very lack of authority which made us unwilling to accept, and which still makes us unwilling to accept some of the statements as an expression of Dr. Murphy's sincere convictions.

One other defect we believe should be remedied. While the exact dates of injury, of admission to the hospital, etc., frequently are given, yet the date of the lecture or operation never is mentioned; so that the duration of the condition before operation can only be inferred.

Apart from these criticisms, nothing but praise can be uttered. The wealth of material is remarkable; Murphy's dialectic and his familiarity with all departments of surgery are wonderful; the illustrations are admirable; the results of treatment are incomparable; and the work as a whole presents a fascination to the student of surgery which has rarely or never been equalled. In addition to all these factors of merit, there has been added a most useful and complete index. May we have many more volumes!

A. P. C. A.

PATHOLOGY AND TREATMENT OF DISEASES OF WOMEN. By A. MARTIN, Professor und Direktor und PH. JUNG, Professor und Oberärzt der Universitäts Frauenklinik in Griefswald. Only authorized English translation, written and edited by HENRY SCHMITZ, M.D., Professor of Gynecology, Chicago College of Medicine and Surgery; Medical Department, Valparaiso University; Attending Surgeon, St. Mary's of Nazareth Hospital; Attending Gynecologist, Frances E. Willard National Temperance Hospital, Chicago. 187 illustrations, 25 of which are in colors. Fourth edition. New York: Rebman Company, 1912.

THAT this book has passed through its fourth edition is sufficient proof of the favorable impression it has made upon the profession. Starting as a compilation of lectures which Martin delivered in a vacation postgraduate course at the University of Berlin, this last edition embraces not only a summary of the author's rich experience, but also a *resume* of the more important work that has appeared on the subject. The bibliography includes two hundred and eighty complete references which are in themselves of considerable value, since they mark in many instances the epoch-making contributions to gynecological literature. On the whole, the translation is well done, but throughout the book are several examples of literal translation at the expense of good English. In these days of many books on the same subject, it is extremely rare to find any originality either in the method of presentation or in the subject matter contained; an exception to this general rule is not found in this book. We say this not in the spirit of unfavorable criticism, but rather as a statement of fact to better enable the reader of this review to appreciate what the book offers. In less than five hundred pages, the authors present a comprehensive review of the whole subject of gynecology, including not only pathology and treatment, as the title implies, but symptomatology and diagnosis as well. The pathology of the various lesions is fully described not only in its gross and microscopic characteristics, but also in its practical bearing on the clinical picture; the theories of mooted questions are stated briefly but clearly. The book is especially valuable in its exhaustive descriptions of symptomatology and diagnosis where no effort is spared in presenting a clinical picture which includes the manifestations of each lesion even in its rarer phases. Treatment likewise receives its due share of attention, and embraces not only the accepted operative procedures, but also the local and general measures which may be applicable to the individual lesion. We can highly recommend this book as a concise presentation of the entire subject of gynecology from its scientific as well as its practical viewpoints.

F. E. K.

MANUAL OF SURGERY, REGIONAL SURGERY. By ALEXIS THOMSON, F.R.C.S. (Edin.), Professor of Surgery, University of Edinburgh, and ALEXANDER MILES, F.R.C.S. (Edin.), Surgeon to Edinburgh Royal Infirmary. Fourth edition. Vol. II; pp. 891; 274 illustrations. Vol. III; pp. 547, 220 illustrations. Edinburgh, Glasgow, and London: Henry Frowde and Hodder and Stoughton, 1912.

THE second of the three volumes into which this work is divided is devoted to regional surgery, and includes that of special regions as of the ear, nose, throat, and female genitalia, but not of the eye. The pages are unusually small for a book of such ambitious purposes, and emphasize the chief characteristic of the work, condensation. Each chapter begins with a brief summary of the surgical anatomy of the part discussed. In these days of systems of surgery, monographs, and voluminous papers on surgical topics, the text-books covering the whole field of surgery, by one or a few authors, are becoming scarce. The authors have demonstrated that they can still be made very serviceable. By careful elimination, avoidance of repetition, and the subordination of the unimportant to the important, they have produced a condensed textbook that will be particularly valuable to students and busy practitioners. The quotations from recent writers are numerous although there are very few references to the exact sources of the information. The discussion of operative treatment is very brief, which is to be explained by the fact that the third volume is devoted to operative surgery. Still it would help the reader of the second volume if cross references were employed to indicate where in the third volume the operative treatment of a given condition is more fully discussed. The illustrations are in the main photographic, and serve the purpose satisfactorily. A few, however, are not very serviceable. For instance, on page 257, there is an illustration of a suicidal cut throat wound, the space for which could be better filled in by text. Angina Ludovici, in the opinion of the reviewer, could be described more accurately. It is nothing more than a severe submaxillary cellulitis which has invaded the floor of the mouth and the pharynx with a resulting edema of the larynx, and a general realization of this fact will save many lives. Pus is seldom detected, not because it forms early and is under great tension, but in some cases because there is none present, and these are the worst cases, and in others because it is small in quantity and buried deeply under thick edematous tissue. Constitutional symptoms are not always marked, they are sometimes practically absent, but this does not lessen the danger. Bronchoscopy for the removal of foreign bodies from the bronchi should receive more attention. On the other hand, the preference over thoracoplasty given to the injection of Beck's bismuth is justified

by the recent literature. The advice to always operate on strangulated hernia as early as possible and to employ taxis only when operation is refused or contraindicated, is also in order.

The third volume, devoted to operative surgery, like the first on general and the second on regional surgery, represents a careful and skillful condensation. It is brought well up to date and affords to the busy surgeon, as well as to the student, a concise but clear description of the formal operations of general surgery. The special fields of the ophthalmologist, laryngologist, and gynecologist, are not invaded. The illustrations with few exceptions answer the purpose for which they were intended. This, however, cannot be said of a few, for instance, of Fig. 12 on page 23, illustrating the ligation of the internal mammary artery. In order that such an anatomical illustration may be easily understood, it should show clearly the sternum and clavicle, particularly the former. The only guide in the illustration is the nipple which is too variable in position and too far away from the artery to serve the purpose satisfactorily. For the control of hemorrhage in amputation at the hip-joint, preference is given to the preliminary ligation of the femoral or external iliac artery. MacEwen's manual method of compressing the abdominal aorta, Momberg's abdominal tourniquet, and Spence's skewers are all, apparently, preferred to Wyeth's pins, which receive very brief mention. Wyeth's method of amputation, which permits the use of his pins and a tourniquet, are not spoken of. Most American surgeons would disagree with this position. With a few exceptions like these, there is little to be criticised and much to be commended in this volume which, with the other two volumes, represent a valuable *resume* of modern surgery. In both volumes the work has been well done and should continue to receive the encouragement it deserves. T. T. T.

THEORY AND PRACTICE OF THYROID THERAPY. By HERBERT EWAN WALLER, M.R.C.S., England, L.R.C.P., London, Honorary Anesthetist Birmingham Dental Hospital. Pp. 154. London: John Bale, Sons & Danielsson, Ltd.

THE first impression one obtains after reading Waller's book is that there are apparently few diseases which have not their origin influenced by thyroid secretion and their course benefited by thyroid medication. He presents numerous conflicting theories for the causation of various diseases, and cites cases of seemingly opposite character, benefited by the same course of treatment, without explaining satisfactorily the rationale of such procedures. The importance of the relationship of thyroid secretion to calcium

assimilation is well emphasized, and valuable suggestions for the treatment of malnutrition and kindred diseases in children are given. Several plausible theories are advanced in explanation of the action of iodine on the thyroid gland in goitre and Graves' disease, and the influence of arsenic on thyroid activity is given as the reason of the value of the drug in such diseases as lymphadenoma, various skin affections, etc. Diverse opinions as to the action of the salicylates on thyroid secretion are mentioned, and even carcinoma and tuberculosis are brought into the realm of possible beneficiaries of thyroid medication.

Through the maze of conflicting theories and facts concerning the thyroid gland, much valuable information may be gleaned, especially relative to the best mode of administering the drug. The author "ventures to think that an account of my wanderings into this little known land may prove interesting to all, and perhaps of assistance to some in enabling them to penetrate still farther." As such the book has severd a useful purpose and should be deservedly popular. T. C. K.

ZAHNÄRTZLICHE CHIRURGIE. By PROF. DR. MED. FRITZ WILLIGER, Direktor der chirurgischen Abteilung des Königlichen zahnärtzlichen Universitäts-Instituts zu Berlin. Second edition; pp. 142; 114 illustrations and 9 plates. Leipsig: Dr. Werner Klinkhardt.

IN this work are considered most of the important surgical diseases of the teeth and mouth, with full details of operative and after-treatment. The title of the book, *Dental Surgery*, seems inadequate, in view of the fact that it deals with conditions beyond the scope of dental practice, while at the same time it does not go into the details of the ordinary operations performed by the dentist.

The author justly lays great stress upon the importance of the *x*-rays in diagnosis—the most valuable means at our disposal in bringing to light obscure lesions of the jaws. Dental cysts are divided into two classes—follicular and radicular. It seems to us that the latter variety would better come under the term "chronic abscess," since it always follows infection from the pulp canal. Dentists would do well to follow more often the advice of the writer to remove all teeth or roots having sinuses opening upon the skin, instead of persisting in useless attempts at conservation of the offending teeth. The author condemns the extraction of the second molar in any case of difficult eruption of the third molar. Most authorities hold that extraction of the former is quite justifiable under some conditions, for example, where easy removal of

the second molar would allow the third molar to come up and take its place. The chisel and mallet used by the author should have no place in operations on the teeth and jaws when we have at hand a far superior instrument in the electric surgical engine. For most of the operations described in the book, local anesthesia with novocain is recommended, though a timely word of caution is given against its employment in acute infective processes. The bad after-effects of injection under pressure of a local anesthetic in the region of the jaws, not so much of the drug itself, but of the spreading of the inflammatory process, are too frequently seen to make it safe as a routine measure. Several subjects which seem to us to come within the scope of the specialist in this region have been omitted from the book. For example, fractures of the jaws, cleft palate, and ankylosis of the temporomandibular joint, should have a place just as much as dislocation of the lower jaw.

The text is illustrated by many good photographs and diagrams, and the book should be valuable to both physician and dentist as giving a concise presentation of the subject. No one after reading it will deny that the diagnosis and treatment of lesions of this somewhat neglected region form a true specialty.

R. H. I.

TEXT-BOOK OF OPHTHALMOLOGY IN THE FORM OF CLINICAL LECTURES. By DR. PAUL ROEMER, Professor of Ophthalmology at Griefswald. Translated by DR. MATTHIAS LANCKTON FOSTER, Member of the American Ophthalmological Society; Member of the American Academy of Ophthalmology and Oto-Laryngology. Vol. I, Pp. 275; 186 Illustrations in the Text and Thirteen Colored Plates. New York: Rebman Company, 1912.

THIS, the first volume, deals with the conjunctiva, cornea, iris, and lens. The first chapter contains a short description of the anatomy of those structures and of the methods of clinical examinations of the same. Their diseases are considered in the following three chapters. The form in which the work is cast, being that of clinical lectures, permits of a certain familiarity and vividness not found in the ordinary didactic text-books. Etiology and pathology are based on the latest discoveries in this field. The cell inclusions discovered by von Provaczek and Haberstaedter in trachoma in the epithelial cells of the conjunctiva are referred to, as also Heymann's demonstration that these peculiar cell formations are present during a blennorrhea, the relation of which to trachoma has not been fully established. As regards the genesis of senile cataract, the views of Becker, Schoen, Moerner, Hess, etc., are quite fully given. The author's own theory is that the

subcapsular senile cataract is a metabolic disease of the lens, due to the influence of some poison upon the protoplasm.

Clear descriptions are given of the tuberculin test and Wassermann reaction. In regard to the value of the latter, Leber is quoted, who found that between 80 and 90 per cent. of the patients with secondary or tertiary syphilis who have positive syphilitic eye diseases and 90 per cent. of those with diseases of the eye due to hereditary syphilis react positively. At the same time, sole dependence should not be placed on the outcome of the reaction, but each patient should be submitted to a thorough clinical examination.

We cannot pass this book without a tribute to the excellent work of the translator, Dr. M. L. Foster. (The first ten lectures were translated by the late Dr. P. W. Shedd.) Dr. Foster refers in his preface to the difficulty of reproducing the power, vividness, and force of the original German. He is to be congratulated upon his success in accomplishing this difficult task.

We look forward with pleasure to the remaining volumes, and bespeak for the work a wide circulation among all who are interested in ophthalmology. T. B. S.

THE CARE OF THE SKIN AND HAIR. By WM. ALLEN PUSEY, A.M., M.D., Professor of Dermatology in the University of Illinois. Pp. 182; 3 illustrations. New York and London: D. Appleton & Co., 1912.

THE attractive little volume of Dr. Pusey should prove of worth both to the physician and to all those individuals who are interested in the proper care of the skin and the hair; particularly in regard to the preservation of their health. Although the subject is quite well covered, the clearness of description and the simplified manner of narration makes even the histological details understandable to any reader. The little volume fills a niche of its own, and is a clear answer to the many questions asked in regard to the hygiene of the skin and the nails. The important questions of sleep, exercise, fresh air, sunlight, diet, clothing, and bathing are fully discussed in regard to their influence on health. The injurious and also the beneficial soaps are described in some detail. The much-abused face powder is thoroughly analyzed. The concluding portions of the book are devoted to the commoner skin conditions, and a few preparations are mentioned for their treatment.

F. C. K.

PROGRESS

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UNDER THE CHARGE OF

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Erythrocyte Inclusions following Splenectomy.—O. ROTH (*Zeitsch. f. klin. Med.*, 1912, lxxvi, 23) reports a case of congenital hemolytic jaundice; the spleen was removed in 1900, relieving the symptoms greatly. The blood showed diminished resistence of the red blood cells (minimum resistance 0.58 to 0.60 per cent. sodium chloride). It is probable, since the patient had jaundice from childhood that the condition was congenital jaundice and not "splenic anemia," as diagnosticated at the operation. The unusual feature of the case was the blood finding. The red blood cells varied between 5,600,000 to 6,400,000; the hemoglobin between 100 to 114 per cent., while under observation in 1912. The red blood cells showed anisocytosis with a preponderance of small forms, but with no poikilocytosis. There were a moderate number of red cells with polychromatophilic staining; basophilic granules were infrequent, as were normoblasts. Nuclear particles in the erythrocytes were very abundant. In the fresh, unstained specimen it was evident that a large proportion of the red cells presented 1 to 2 round, quite refractive inclusions, which seemed to move somewhat, though slightly, within the cell. Generally they were the size of a very small coccus, but at times the diameter amounted to about one-sixth of that of the red blood cell. When the blood was stained with Giemsa's stain, it was seen that these bodies were red, structureless, sharply outlined bodies; they possessed all the characteristics of the Howell-Jolly bodies. Usually only one, rarely two bodies were seen. With May-Grünwald's stain, the bodies were stained blue, with Unna's polychrome methylene blue, they were bluish-red. They were very numerous, in one instance cells

containing them numbering 20,000 per c.mm. Furthermore, about one-half of the red cells presented very fine dots, stained blue with Giemsa's stain; usually there was one dot, or, at most, three in a cell. Many of the cells showing Howell's body contained these dots. The dots described are not identical with Weidenreich's chromatin dots, which stain red with Giemsa's stain, and are usually double in the cell.

Transfusion Fever.—H. FREUND (*Deutsch. Arch. f. klin. Med.*, 1912, cvi, 556) has found that the febrile reaction which follows intravenous transfusion of blood is produced even when the animal (rabbit) is given his own defibrinated blood. The cause of the fever, he has shown in his previous work, must be sought in the corpuscular elements of the blood, and since the relationship of clotting (defibrination) to breaking up of platelets is well known, attention was directed particularly to the platelets as the cause of transfusion fever. Injection of fresh, unclotted blood caused no elevation of temperature. Similarly, blood to which sodium citrate had been added produced no febrile reaction in 24 experiments, but when the citrated blood was shaken with glass pearls—this manipulation injuring the platelets, as previous observers have shown—fever was noted in 7 of 11 experiments. The nature of the pyrogenous substances in the platelets is not clear. The fibrin ferment, Freund thinks, is excluded. Whether the proteolytic ferment, which is abundant in the platelets is concerned in the production of the fever must be investigated. Several days after the second injection of platelets—occasionally after the first—the animals became weak, emaciated rapidly, and died (in all 30 experiments). Autopsy showed fatty degeneration of the liver, and, to a less extent, of the heart and kidneys, and a few small hemorrhages in the pleura and epicardium. The clinical course corresponded to that of "ferment intoxication."

The Prevention and Cure of Beriberi.—FRASER and STANTON (*Lancet*, 1912, lxxxiii, 1005) recount their recent investigations on beriberi. Rice is rendered harmful by the milling and polishing process to which it is subjected. In this way there is removed from the grain some substances of high physiological importance, the absence of which results in the production of polyneuritis in fowls and beriberi in man, when a diet is consumed of which polished rice is the staple. This substance may be in itself essential to nerve nutrition, or act by rendering other substances available. It appeared possible that if the active substances could be separated from the mixture of the rice mills' polishings, and given in a readily available form, an agent might be obtained which would be of value in the treatment of patients suffering from beriberi. The fat-free polishings were extracted in alcohol, in which the active substance is soluble. With this solution fowls suffering from the disease experimentally produced and continued by polished-rice feeding were cured, 5 out of 6. Eight fowls fed on polished rice plus the extract remained in good health. The experiments demonstrate the value of such an extract as a curative and prophylactic agent. Rapid curative effects in humans must not be anticipated, as extensively degenerated nerves require time for their

regeneration; but patients placed under favorable conditions and receiving daily, after food, a dose of this extract will have their prospects of recovery enhanced, and their period of invalidism lessened.

The Relation of Gastric Secretion to Rheumatoid Arthritis.—The failure of alkalies to improve the joint affections in rheumatoid arthritis, although markedly successful in acute rheumatism, was noted by earliest observers. It seemed to the authors, WOODWARK and WALLIS (*Lancet*, 1912, clxxxiii, 942), that the absence of hydrochloric acid in the gastric juice of one class—hydrochloric acid being well known as a germicide—might explain the demarcation between cases with an apparently similar degree of pyogenic infection. The gastric juice after an Ewald test-meal, a piece of dry toast, and one pint of tea, was examined in 10 typical cases of chronic rheumatoid arthritis. There was a diminution of the free and combined hydrochloric acid in every case. An excess of mineral chlorides pointed to a process of neutralization. The lowered ferment activity was striking. The analyses closely resembled those in gastric carcinoma, and in the absence of further proof of the latter, it is evident some definite gastric changes are present in the rheumatoid arthritis. Confirmation to a certain extent was obtained by the relief on treatment based on these results—an acid mixture by mouth.

Etiology of Dementia Paralytica.—At the present day, it is almost universally claimed that dementia paralytica is a manifestation of syphilis. In the judgment of ROBERTSON (*Lancet*, 1912, clxxxiii, 872), a satisfactory case has been made out for no more than the fact that previous infection by the Treponema pallidum strongly predisposes to the development of dementia paralytica and tabes dorsalis. Robertson has isolated a number of the diphtheroid group of bacilli, B. paralyticans, which he believes to be of etiological importance. With hemoglobin containing media, the Bacillus paralyticans can be constantly demonstrated in the genito-urinary tract and nasal mucosa of the paralytic. The nasal infection can be traced along the lymphatics, through the base of the skull to the intracranial lymphatic system. A culture can be obtained from the spinal fluid in considerable number of the cases. Intraspinal injection of living cultures in rabbits has produced lesions in the cord identical with those which occur in the brain of the paralytic. Several animals did not develop paresis until eighteen months or two years later. Out of 16 animals infected by the genito-urinary tract, 10 have developed paresis. Further, it has proved to be a contagious venereal disease. Three male rabbits developed well-marked ataxia and paresis of the hind limbs, after being placed with females whose genital tracts had been infected with the bacillus. Finally, by vaccine treatment, cases of early tabes have been much improved. By intraspinal injection of an antiserum produced in sheep, striking results have been obtained.

Sporotrichosis in the United States.—RUEDIGER (*Journal of Infectious Diseases*, 1912, xi, 193) has collected 47 cases of infection of the human subject with the Sporothrix fungus in the United States, and to these adds 10 new cases. Only 24 of these 57 cases were confirmed

by a cultural or microscopic diagnosis. Five-sixths of the total cases have been observed in the Missouri Valley of Kansas, Missouri, Iowa, Nebraska, South Dakota, and North Dakota. Of 22 authentic cases in North Dakota, every one occurred along the Missouri River. Ruediger believes the organism lives as a saprophyte upon grains, grasses, or other vegetation, from which the infection is contracted, rather than each case being related to another preëxisting case. The disease is most common among farm laborers, and the cases are nearly always isolated. In only two instances did a second case develop in an individual who had associated with a person suffering from the disease. There is no evidence for the infection in man being contracted by horses. Histologically the nodules in the early stages are made up of embryonal tissue infiltrated with plasma cells, and polymorphonuclear leukocytes, and occasional giant cells. Necrosis occurs later, and secondary infection with staphylococcus. It is easy to locate the sporothrix from these nodules, and they can be found in sections of the tissue.

Complement Fixation Test for Gonorrhea.—O'NEILL (*Boston Med. and Surg. Jour.*, 1912, clxvii, 464) has analyzed the results of application of the complement-fixation test for gonorrhea at the Massachusetts General Hospital. One hundred and nineteen urethral cases were divided into three classes: (1) 60 cases, with definite clinical manifestations, such as organisms, prostatitis, vesiculitis, or stricture, yielded 50 with a positive test. In the remaining 10 the infection was very remote. (2) Of 30 clinically negative cases, 9 were positive, 5 of whom acknowledged a recent infection. (3) Eighteen of 27 borderline cases were positive. These cases showed a few leukocytes or shreds in the urine after prostatic massage. Twenty-four of 48 cases of lesions in the lower female genital tract were positive, and all of these showed either gonococci or a discharge. There were 25 cases of arthritis, 10 of whom had evident genito-urinary gonorrheal lesions. All but one reacted positively; 2 of 4 with history only were positive. Twelve of 20 cases of pelvic disease were positive, all with history or present infection. In summary, the following is interesting: Cases with gonorrheal history, clinically uncured, 109; 95 positive, 14 negative. Cases with doubtful cure, 27; 9 positive, 18 negative. Cases with doubtful diagnosis, 16; 5 positive, 11 negative. Negative to gonorrheal history, 17; 17 negative. Negative by examination, 52; 9 positive, 43 negative.

The Production of Leukocytes in the Treatment of Mental Diseases.—Recognizing that some forms of mental disorder are due to toxins, many of them microbic in origin, BROWN and ROSS (*Journal of Mental Science*, 1912, lviii, 389) believed it justifiable if empiric, to stimulate, if possible, the natural defences against toxemia. Brown and Ross employed nucleic acid as a drug which will produce a leukocytosis. Nine patients were treated, 5 with acute delirious insanity, 2 with melancholia, 1 with dementia præcox of the catatonic type, and 1 with general paralysis. A 5 per cent. solution of nucleic acid diluted with normal saline was injected subcutaneously every second, third, or fourth day in doses increasing from 15 up to 60 minims. The tem-

perature invariably rose 1 to 1.5 degrees in twenty-four hours, and the increase in leukocytes occurred on the second day after the injection. The average counts of 8200 to 8800 before injection were increased to 20,000 and 30,000 without any change in the relative percentage of the different cells. The shorter the interval between the injections, and the larger the doses, the greater was the reaction obtained. Treatment was continued for 12 to 15 doses over two to three weeks. One of the melancholia cases became quieter and rational. The physical improvement and the decrease in acute excitement in the 3 cases of delirious insanity was marked. No change could be detected in the mental condition of the 5 remaining cases. Brown and Ross believe the procedure rational in principle, of proved utility, and they advise its further use.

Determinations of the Nitrogen and Salt Content of the Sweat of Nephritics.—P. TACHAU (*Deutsch. Arch. f. klin. Med.*, 1912, cvii, 305) has determined quantitatively the nitrogen and sodium chloride of the sweat in a series of nephritides, the object being to determine to what extent the sweat bath relieves the diseased kidneys. The baths were continued in each instance for one hour, and all the sweat was collected. For nitrogen surprisingly low values were obtained. The highest excretion amounted to only 0.49 gram of nitrogen (1 case), usually only about one-half this amount or less. The chlorides, on the other hand, varied between 1.31 and 2.05 grams. Tachau, therefore, believes that any beneficial effects of sweat baths are not attributable to the removal of nitrogen through the skin. The withdrawal of sodium chloride, however, is sufficiently great to be of value, especially in edematous patients.

Clinical and Serological Studies of Paroxysmal Hemoglobinuria.—J. MATSUO (*Deutsch. Arch. f. klin. Med.*, 1912, cvii, 335) has had the opportunity of observing 11 cases of paroxysmal hemoglobinuria within the last year. A number of points of interest were brought out. In 10 of the cases cold alone precipitated the attacks; in the remaining case both cold and physical overexertion were capable of bringing on a paroxysm. In 4 of the patients there was acquired syphilis; in 7 lues was congenital. The hereditary nature of the condition was illustrated by its occurrence in a father and daughter, while in another case it was found that a sister and two cousins of the patient suffered from the disease. Serologically, all the patients exhibited autohemolysis after the original method of Donath and Landsteiner, though in some instances complement was exhausted, and it was necessary to add it before hemolysis occurred. Like other observers, Matsuo noticed that the autohemolysis was less pronounced the oftener the attacks of hemolgobinuria. Variation in the autohemolysis was dependent not only upon differences in the quantity of complement, but also of autohemolysin. In 45 per cent. of his cases, Matsuo has demonstrated isohemolysins in the blood. Usually, the red blood corpuscles of a hemoglobinuric whose blood contains isolysins are protected from the action of the isolysins of a second patient. Salvarsan was without effect on the course of the disease.

SURGERY

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Intratracheal Insufflation Anesthesia.—COTTON and BOOTHBY (*Annals of Surgery*, 1912, lvii, 43) say that intratracheal insufflation or respiration is the only artificial method that absolutely provides for a sufficient aëration of the lungs, regardless of the respiratory movements of the patient, and that properly administered and safeguarded, it can be rendered devoid of intrinsic danger. In consequence, anesthesia by this method is indicated whenever the operation is about to interfere in any way with the ability of the patient to voluntarily respire. Therefore it ought to be used in all intrathoracic work, and in extensive operations about the head, neck, and mouth. Of the various anesthetics to be used with this method, ether with air, preferably supplied by a foot pump, is the most applicable for general use; however, nitrous oxide-oxygen with minimal quantities of ether may occasionally be the anesthetic of choice. To prevent deaths from emphysema, no matter what form of apparatus is used, it must be provided with a safety-valve by means of which the intrathoracic pressure cannot exceed 15 mm. of mercury.

Replacement of the Extirpated Bladder by the Cecum.—LENGEMANN (*Zentralbl. f. Chir.*, 1912, xxxix, 1697) calls attention to the very restricted employment of excision of carcinoma of the bladder and the very high mortality of the operations which have been done. He also calls attention to the operation performed by Makkas for exstrophy of the bladder, consisting in an anastomosis between the ileum and transverse colon, a division of the ascending colon with closure of the divided ends and the passage of the appendix through the abdominal wall to be used as a urethra. At a second operation the ureters with a piece of the bladder were implanted into the isolated cecum, which then became a substitute for the bladder and from which the urine escaped externally through the appendix opened at its external extremity. Lengemann says that little use has been made of the operation. He employed, without realizing it, a very similar operation, to permit the extirpation of a cancer of the bladder. The operation is summarized as follows: At the first sitting the cecum, ascending colon, and 30 cm. of the ileum were totally isolated. The proximal end of the ileum was implanted into the transverse colon near the sutured end. The

appendix was passed through the abdominal wall and the end removed. At the second sitting a few weeks later, after frequent irrigation of the "new bladder," the normal bladder was extirpated, the closed end of the ileum brought down, and the ureters implanted into this portion of the intestine. There was at first a marked constipation, followed by a severe diarrhea. The urine was at first very cloudy with mucus and pus, notwithstanding the frequent irrigations. After some weeks the urine showed only some flakes of mucus. The new bladder contained 500 c.c., but the patient preferred the frequent introduction of a catheter, and was much pleased with the results. Among the advantages claimed for the operation were the following: Small danger of infection because of the absence of feces from the isolated piece of intestine. The ileocecal valve and peristalsis in the ileum offer a certain protection against backflow. The implantation of the ureters can be performed with much less tension into the movable end of the ileum than into the less movable cecum, as in Makkas' operation. The urine unmixed with feces does not cause dangerous absorption, and does not irritate the mucus membrane of the lower colon and rectum, as when the ureters are implanted into the sigmoid flexure. The new bladder contains easily 500 c.c. and is continent.

Stasis Hemorrhages Due to Traumatic Compression of the Trunk, —Lang (*Deutsch. Zeitschr. f. Chir.*, 1912, cxx, 76) presents an extensive study of this subject, and reports 7 cases, the first with much detail. In a traumatic compression of the trunk, from the increased intrathoracic and intra-abdominal pressure, a backward pressure in the vessels is produced, most markedly in the large veins, which is transmitted in greatest part to the upper parts of the body and to a less extent to the lower parts. The chief effect is to be seen in stasis hemorrhages in various parts of the body. The increased blood pressure is due substantially to the passive compression of the body cavities, and therefore of the lumina of their contained vessels. If reflex "active factors" (closure of the glottis, body exertion) play a part, they only favor the extravasation of the blood from the vessels, but are not necessary factors. The almost constant skin ecchymoses in the region of the tributaries of the common facial vein, is due to valve insufficiency and impaired function of the intima duplicatures in these veins. The corresponding mucus membrane hemorrhages are due to similar causes. With a very high venous blood stream, in the presence of a decreasing blood pressure, the functionally competent valves may be insufficient against the impact. The relatively rare occurrence of intraocular hemorrhages and the complete absence of brain hemorrhages, is explained by a normal intraocular and intracerebral pressure, which, with the aid of the clothing (shirt collar, folds in the clothing) can prevent the occurrence of the extravasations. The brain veins are especially protected by a valve-like arrangement at the point of emergence of the sigmoid sinuses into the jugular veins.

The End Results of Double Fractures.—Molineus (*Deutsch. Zeitschr. f. Chir.*, 1912, cxx, 137), under this title, discusses fracture from pronation of the foot, or the Dupuytren fracture. The clinical symptoms of this fracture are given as follows: (1) Marked swelling

of the region of the ankle, due to hemorrhage into the joint and surrounding tissues. (2) Displacement of the foot outward and at the same time backward, the axis of the leg passing out of the inner side of the foot. (3) Severe pain. (4) Abnormal mobility of the foot at the ankle-joint. (5) Indirect pressure pain from the calcaneus outward. It is absolutely necessary to give close attention to the reposition of the fractured ends of the bones, and much care to the fracture for a long time afterward. Good reposition is possible only by an overcorrection in supination, according to the severity of the case, and by preservation of this position by the dressing. This fracture should not be treated at home or by an ambulatory dressing, because without adequate assistance and sometimes deep narcosis, a proper dressing cannot be applied. The injury is of such a nature that it can be treated properly only in a hospital. At home the patient often leaves the bed too early and develops very serious secondary results. For a long time the callus is in a so-called rhachitic condition, that is, it is soft and yielding. Even if in the beginning or after supposed union with the foot in good position, too early use of the foot allows it to turn outward, so that the troublesome traumatic flat foot develops. After fourteen weeks it is usually necessary to correct the condition by operation.

Hypertrophic Arthritis.—Jacobsohn (*Mitt. a. d. Grenzgeb. d. Med. u. Chir.*, 1912, xxv, 589) says that almost all authors handle chronic joint diseases differently. They have their own conceptions, classifications, and nomenclature. He concerns himself with the study of hypertrophic arthritis, and regards it as a well characterized disease. Its separation from other chronic joint diseases, especially those with atrophic degenerative processes, the progressive so-called chronic rheumatic affections, should not be difficult. Unlike them it is mono- or oligo-articular and is non-progressive. It affects males by preference. There are often palpable prominences and foreign bodies, and often joint creptitation. There is no ankylosis, and muscle atrophy is not very pronounced. There are rarely other trophic disturbances or marked constitutional disturbances. The *x*-rays show little bone atrophy, but always protuberances, and often cartilaginous or bony loose bodies in the joint without ankylosis formation. Often when the disease has existed only a short time, the *x*-rays show striking changes. The atrophic joint diseases often show only slight changes after they have existed a long time. The pathological anatomy shows that the hypertrophic alterations begin in the cartilage, the atrophic in the synovial membrane. The name "arthritis deformans" should not be employed. The adjective "hypertrophic," brings into prominence its most characteristic sign. In all other joint diseases the hypertrophic symptoms are absent and only to this disease can the name be applied with justice. In the treatment rest should be avoided and motion encouraged. While rest will relieve the pain, it leads to muscle atrophy, the avoidance of which is the most important indication. Even with the existence of a joint effusion, rest in bed or a fixation dressing should be employed as little as possible. In a remarkably short time muscle atrophy with all its unpleasant consequences, develop. These are impaired function, weakness, edema, etc., and

cause the patient to spare more and more the affected joint, and thus retard the improvement and healing for weeks and months. The movement therapy gives much better results. For those who cannot walk or stand, massage and medico-mechanical therapy is indicated. The hyperemia treatment is often indicated, either in the form of the hot air apparatus (active) or the suction apparatus (passive). Faradization can also aid. In some cases, usually those with hip-joint involvement, an orthopedic apparatus will be useful. Operation is restricted to cases with joint bodies, which impair very much the movements of the joints, cause much pain, or become caught. No noteworthy influence is exerted by the *x*-rays, as far as known, while radium should receive some consideration as a curative or at least an aid.

Round Ulcer of the Stomach and Duodenum as a "Secondary Disease."—Rossle (*Mitt. a. d. Grenzgeb. d. Med. u. Chir.*, 1912, xxx, 766) says that the round ulcer of the stomach and duodenum is a disease which is so frequently associated with certain other diseases and disturbances of health, that it must have some relationship with them. In many cases such a relationship can be shown that the round ulcer seems to be a "secondary disease." Its origin depends not upon transmission through the blood, but in all probability upon the reflex effect of nerve irritation. The experimental investigations up to the present time speak for irritation in the vagus region. These results in the stomach are of especial importance because of the dependence of the muscle movement and secretion upon the nerves. Erosions and ulcers are only different stages and grades of the same process. For the development of erosions, spasms of the muscularis mucosa may be of special importance, because the veins and arteries are occluded where they pass through the muscularis. This occlusion, according to the character of the concerned vessels, leads to hemorrhagic infraction or to ischemia, both of which are followed by local digestion necrosis of the mucus membrane, especially in the presence of hypersecretion. The places of predilection of the round ulcers are where the spasmodic folds of the musculature are especially prolonged.

Diagnosis and Treatment of Aneurysms of the Internal and External Carotids.—Liebault and Daudin (*Arch. gén. d. Chir.*, 1912, vi, 1433) say that reports of cases of the internal carotid are not frequent and that those of the external carotid are still more rare. They had the opportunity of seeing one of each variety, with an interval between them of one month, and for this reason they undertook a study of the two conditions. In the case of the external carotid aneurysm, two catgut ligatures were placed around the external carotid artery above the superior thyroid branch and 1 cm. apart. The aneurysm gradually disappeared, and six months after the operation the good results were still maintained. The patient with the aneurysm of the internal carotid refused operation. If in a cervical tumor in the cervical or cervicopharyngeal, on inspection and palpation, pulsations synchronous with those of the pulse, are detected, and it is possible to register them with the sphygmograph, and if in addition the stethoscope permits one to hear a systolic bruit, the diagnosis of a carotid aneurysm is justified. If the aneurysm is located on the external carotid, it is often

only cervical. It is accompanied by pain, causes at times but not always a disappearance or a diminution of the intensity of the temporal pulse. Finally in its pharyngeal form it forces the tonsil directly inward, passing to a certain degree between the two pillars of the palatal arch. On the other hand the aneurysm of the internal carotid is never completely cervical. It is remarkably indolent and makes a prominence in the posterior and lateral wall of the pharynx, pushing the whole tonsillar region forward and inward, since it is posterior to the posterior pillar of the palatal arch. From the therapeutic standpoint the first of the 2 cases proves that in aneurysm of the external cartoid, the constriction of the common carotid will, perhaps, be preferable to the ligature, diminishing the chances of rupture of the sac and favoring a cure, while respecting the cerebral circulation. This constriction can be obtained by a silk ligature or a metalic ring, or by plicating the arterial wall by suture.

THERAPEUTICS

UNDER THE CHARGE OF

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Neosalvarsan.—KERL (*Wien. klin. Woch.*, 1912, xxv, 1787) says that neosalvarsan is superior to salvarsan mainly because of its easy solubility in water. The remedy is at least equal to the older preparation in effectiveness. Many untoward by-effects have been observed following the use of neosalvarsan, but Kerl attributes these to the higher dosage given of neosalvarsan. He believes that untoward symptoms are less than with salvarsan, where equivalent amounts are given. Untoward by-effects are usually only observed after the first injection of neosalvarsan, therefore, it is advisable to begin the treatment, especially of cases in very active stages of syphilis, with smaller doses. It is also necessary, to avoid unpleasant symptoms, that the intervals between doses should not be too short.

Vaccine Therapy of Whooping Cough.—BAMBERGER (*Amer. Jour. of Diseases of Children*, 1913, v, 23) reports 6 cases treated with a vaccine prepared from several strains of the Bordet bacillus. The vaccine included the organism of the case treated, which he obtained by swabbing the thorat and then flating the cultures until a pure culture was obtained. He gave 20,000,000 bacilli every other day, giving to individual cases from five to fifteen injections. There were no general symptoms, such as fever, rashes, malaise, general pain or vomiting, occurring as a result of the injections and only very slight local reactions at the site of the injections. The treatment did seem to lessen the severity of the disease, and shorten complications, although it did not seem to shorten the duration of the disease.

The Absorption of Digitoxin from Digitalis Preparations and its Relation to By-effects.—Gottlieb and Ogawa (*Münch. med. Woch.*, 1912, lix, 2265, 2339) find that digitoxin, the most active constituent of digitalis, is absorbed more rapidly from digipuratum than from digitalis infusion or the powdered leaves. The rapidity of absorption depends on a number of factors; stasis of the portal circulation may delay it considerably. They differentiate between two kinds of vomiting produced by digitalis: (1) That occurring within three hours after the administration of the drug, and caused by local irritation of the gastric mucous membrane; and (2) that beginning after six or seven hours, the result of the absorption of an excessive amount. They also found that digipuratum in solution is the most rapidly absorbed of all the digitalis preparations. Infusion of digitalis remains in the stomach a long time, and is the quickest to produce vomiting due to local irritation. The article fully confirms the clinical evidence that digipuratum is more quickly absorbed and less irritating to the stomach than are the infusion of digitalis and powdered leaves.

Duodenal Medication of Ipecac in the Treatment of Amebic Dysentery.—Beck (*Jour. Amer. Med. Assoc.*, 1912, lix, 2110) reviews the literature briefly as to the ipecac treatment of amebic dysentery. He is convinced that ipecac has a definite action on the amebæ, and, if properly administered, is undoubtedly the best remedy at our command. What is generally conceded, however, to be the proper method of administration proves such a formidable procedure that the treatment is wholly impracticable. In an attempt to overcome the many objectionable features of the methods in vogue, a simple, rational, and more practical method has suggested itself to him, in the use of the Einhorn duodenal tube. This tube was designed for duodenal aspiration and alimentation, and Beck thinks that it is an ideal instrument for the treatment of dysentery with ipecac. As a rule, patients have little difficulty in swallowing the tube, and comparatively little discomfort afterward. An examination of the stomach contents, to determine the presence of free hydrochloric acid, will help determine whether the tube has passed through the pylorus, which is done by aspirating a little of the fluid and testing with congo paper. After each aspiration the tube is washed out with a little water and clamped. When it has entered the duodenum, the aspiration is slower and more difficult, and the fluid is alkaline and bile-stained. The time required for the tube to pass into the duodenum varies from one to five or more hours. Beck says that ipecac is especially indicated in acute cases and in the exacerbations of the chronic forms. It is said by some clinicians to have practically no effect in cases in which the symptoms are due to a mixed infection. Beck reports 7 cases, all of the chronic type and refractory to other methods of treatment; 3 of these patients had complicating liver abscesses. Powdered ipecac was employed either suspended in mucilage of acacia or macerated in plain warm water. A 2-ounce metallic syringe was used to instil the remedy which represented from 1 to 2 drams of ipecac to the dose in a 6-ounce mixture. Unquestionably much of the success of the treatment depended on the quality of the drug. Those cases which required more than three or four doses, and in

which the amebæ reappeared in the stools were treated by a drug of an inferior quality. On the other hand, the cases treated with a physiologically tested powder yielded after the first or second dose. A detailed report of the cases treated is given, and Beck believes that his study of these few cases shows that the ipecac treatment by duodenal administration is distinctly more efficacious than by other methods. Many other forms of treatment had been employed without avail. The fact that this series of most intractable cases were either permanently cured or relieved for a considerable period of time bespeaks the efficiency of the method. Large duodenal doses of ipecac seem to have no injurious effects. There are occasionally gastro-intestinal symptoms such as nausea, less frequently, vomiting, and rarely diarrhea lasting from twenty to forty-eight hours. Slight general depression may appear with a tendency to lowering of blood-pressure, which rarely amounts to more than 10 mm., even with doses as large as 2 drams.

Effects of Subdural Injections of Leukocytes on Experimental Tuberculous Meningitis.—MANWARING (*Jour. Exper. Med.*, 1913, xvii, 1) found that rabbit leukocytes, injected into the basal meninges of dogs, in doses from 0.7 to 1 c.c., invariably cause death. Horse leukocytes, injected in the same amounts, cause death in about 25 per cent. of the dogs. The injection of foreign leukocytes into the meninges of monkeys causes few if any symptoms. The injection of from 1 to 3 c.c. of horse leukocytes into the meningeal cavities of dogs, simultaneously with the inoculation of the meninges with tubercle bacilli, causes a slight delay in the development of the paralytic symptoms in about half the treated animals. This delay, however, is very slight when compared with the remarkable prolongation of the latent period previously observed after treatment with dog leukocytes. The injection of foreign leukocytes into the meningeal cavities of monkeys has thus far given almost uniformly negative results. In one small group of monkeys, however, inoculated by the method of lumbar puncture, the injection of rabbit leukocytes has been associated with a prolongation of the latent period in one of the treated monkeys, and with a complete prevention of the subsequent tuberculosis in a second monkey.

The Relapses after the Use of Salvarsan.—GAUCHER (*Jour. des Praticiens*, 1912, xxvi, 737) believes that there is no doubt that grave consequences may follow the administration of salvarsan, such as blindness, deafness, various paralyses, arsenical polyneuritis, and death after even small doses. Gaucher is very pessimistic as to the value of salvarsan in the treatment of syphilis, and says that the plan of treatment now recommended by combining mercury with the salvarsan is a confession of the failure of the remedy. Gaucher admits that salvarsan may have a restricted use in syphilis. It is valuable in that it heals up superficial lesions, and prevents the spread of the contagion. Salvarsan may be used for patients who cannot tolerate mercury, or in cases where mercury fails to benefit, but he deprecates its general use for the treatment of syphilis. He discusses relapses following salvarsan treatment which he declares are almost invariably the

result if salvarsan is used alone. He reports 31 cases in detail where there was a relapse of syphilitic manifestations. These cases were taken at random from the records of his clinic at the St. Louis Hospital, and he mentions a number of other writers who have reported similar observations.

Action of Large Doses of Alkalies in Diabetes.—HANSSEN (*Zeitschr. f. klin. Med.*, 1912, lxxvi, 219) gives the details of 8 cases of diabetic coma treated with sodium bicarbonate. He found that the effect of treatment was merely to postpone the coma, and that coma invariably recurred. All of these patients eventually died and, he gives the necropsy findings in his article. The weight was carefully observed in 15 cases of impending diabetic coma, and it was found to increase in every case from 0.1 to 12.4 kilos (27 pounds). This increase of weight is explained by a retention of water due to the alkali.

Salvarsan in the Treatment of Syphilitic and Metasyphilitic Diseases of the Nervous System.—DONATH (*Münch. med. Woch.*, 1912, lix, 2274, 2342) reports excellent results with the use of salvarsan in various diseases of the nervous system. The cases reported comprise 48 cases of syphilis of the central nervous system, divided into cerebral, cerebrospinal, and spinal syphilis. Donath also treated 31cases of tabes and 28 cases of dementia paralytica with salvarsan alone, and also combined with mercury. The best results obtained were in the early stages of these two latter diseases. Donath's article includes details of some typical cases treated.

The Treatment of Diabetes Mellitus.—KRETSCHMER (*Berlin. klin. Woch.*, 1912, xlix, 2221) writes concerning hediosit, first recommended by Rosenfeld, which has the chemical formula $C_7H_{12}O_7$. This is recommended as a substitute for sugar in the dietary of diabetics. It has a sweet, pleasant taste, making it agreeable to take, and is much superior to other substitutes for sugar in that in can be oxidized and be of food value. The glycosuria is not only not increased by the administration of hediosit, but even seems to be diminished by its use. Kretschmer also states that it seems to increase the tolerance of the diabetic for other carbohydrates. With the exception of slight diarrhea when used in large amounts no untoward effects are observed from its administration. Kretschmer believes that it is a distinct addition to the dietary of diabetics and when given in doses of from 10 to 30 grams a day is easily oxidized and utilized in the chemistry of diabetics. He also recommends pantopon in doses of from 0.01 to 0.02 gram three times a day for the treatment of the severer types of diabetes. By its use he was able to cause a decrease in the amount of urine, and to a less extent also in the total quantity of sugar. This effect, however, is only temporary. The article is not very convincing as to the worth of hediosit.

Organic Iodine Preparations: their Pharmacology and Therapeutic Value.—MCLEAN (*Arch. of Int. Med.*, 1912, x, 505) draws the following conclusions with regard to the therapeutic uses of the organic

iodine compounds from evidence presented as to chemical nature, absorption, and excretion, distribution, physiologic action, and clinical results. Up to the present it has not been shown that the organic iodine preparations with the exception of preparations of thyroid, have any specific action in pathologic conditions, except the action of iodin after separation from the molecule. The iodized proteins seem to be of advantage for therapeutic use only insofar as they avoid gastric irritation. The more stable compounds are apparently not entirely split in the body, and are therefore not well utilized, while the less stable compounds have no advantages over the alkaline iodides, either as to local effects or as to rapidity of absorption and excretion. The iodized fats and fatty acids appear to have some advantage when the continuous action of small amounts of iodine is desired. They are more slowly and evenly split, and the amount of available iodine in the blood does not vary from time to time to the extent that it does when the alkaline iodides are administered. The use of the iodized fast in such conditions as arteriosclerosis, bronchial asthma, lead-poisoning, etc., probably has some rational basis, therefore, on physiologic grounds. These substances are also, as a rule, non-irritant to the stomach. The difference in frequency of iodism is probably due to the difference in the amount of available iodine present in the body at any one time. When large amounts of iodine are desired, as in cerebrospinal syphilis, avoiding the danger of iodism would be at the sacrifice of therapeutic efficiency. The use of organic iodide preparations with toxic side actions, due to the molecule or its splitting products, should, of course, be discouraged. The products of iodine with the higher fats and fatty acids are generally free from toxic actions.

PEDIATRICS

UNDER THE CHARGE OF

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The Histological Blood Picture in Infantile Scurvy: Occurrence in the School Age.—F. GLASER (*Berlin. klin. Woch.*, 1913, l, 200) offers several typical cases in a study of the blood picture in infantile scurvy, and reports a case in a boy, aged seven years. Marked pallor commonly occurs in scurvy, but it is not generally known that histological blood pictures arise during the course of scurvy. The reaction of the bone marrow in infantile scurvy is slight, and the appearance of nucleated red cells is not connected with an aplastic condition of the marrow, but marks a definite blood picture in severe cases of scurvy, and is accompanied by abnormal form elements besides normoblasts and megaloblasts. One case reported here was in a child, aged seven months, who had been fed on boiled milk for a long period. The general symptoms were hemorrhages from the

mucous membranes, pain on moving the extremities, hematuria, changes in the cartilages of the long bones of the extremities, swelling along the tibiæ, all of which showed marked improvement under antiscorbutic treatment. The blood picture showed hemoglobin, 40 per cent.; erythrocytes, 800,000; leukocytes, 12,000; polymorphonuclear cells, 40 per cent.; lymphocytes, 60 per cent.; eosinophiles, 1 per cent. There was slight poikilocytosis and polychromatophilia. Large numbers of megaloblasts, normoblasts, and transitional forms were found. Syphilis, tuberculosis, and pseudoleukemia were carefully excluded. In four weeks, under antiscorbutic treatment the blood picture was almost normal, the cartilage changes almost gone and the child fairly recovered. The case of scurvy in the boy, aged seven years, showed pallor, weakness, swollen, bleeding gums, pain on moving the limbs with tenderness on pressure, hematuria, and typical shadows at the cartilages of the long bones shown by *x*-ray plates. The child had been raised on boiled milk and bread, refusing all vegetables, meat, etc. Under raw milk and antiscorbutic treatment the condition cleared up in six weeks. The cartilage changes had also cleared up and showed no shadows under *x*-ray examination. Glaser, therefore, claims this a case of typical infantile scurvy in the school age, of which but 6 cases have been reported in literature.

The Pathogenesis and Etiology of Rachitis.—Max Kassowitz (*Deutsch. med. Woch.*, 1913, xxxix, 201), in discussing an article by Ribbert on rachitis, agrees that the origin of the calcium deficiency in rachitic bones is not in calcium metabolism but in pathological changes in the bone-forming tissues and that these changes are set up by irritating substances in the circulation and soft tissues. He disagrees with Ribbert's views that the irritating substances arise from digestive disturbances due to improper milk feeding. Kassowitz's explanation of these substances rest on the following points: All pediatrists agree that well-developed cases of rachitis and marked softening of the bones of the skull, occur in normally nourished, breast-fed children. Again, in the summer time when gastro-intestinal irritations are most numerous and frequent, the curve of rachitis, both as to frequency and severity, sinks to a low point, while during the winter months when there is little gastro-intestinal trouble, the curve rises higher with each month. The nervous disturbances accompanying rickets follow the same rule. In tropical countries rickets is either unknown, or occurs in a few mild cases. These facts not only contradict Ribbert's view, but offer an explanation of the real origin of these substances. In our climate during the months in which rickets is most frequent, children and infants are housed in for weeks at a time. Rickets is primarily a disease of cities and especially frequent among that class who are poorly and unsanitarily housed. The frequency and severity of rickets increase with the number of persons living in the same room. Hansemann shows that children born in the fall and dying in the spring of the year show a large percentage of rickets, while those born in the spring and dying in the fall show few signs of rickets. Tests on the young of animals bear out this fact, notwithstanding the perfect feeding of the captive animals. In support also of the claim of Kassowitz, that the irritating sub-

stances are "respiratory poisons," is the fact that one finds a large number of infants born with a rachitic rosary and softened bones of the skull, and that these changes are found much more frequently in children born during the winter and spring than in the summer and fall, and are found much more frequently in infants whose mothers passed the months of their pregnancy in a large city, than in those whose mothers came to the city from the country at the time of confinement. These facts impress the truth that the impurities of the inspired air, especially present in the circumstances above mentioned, pass through the circulation direct to the bones and cause the rachitic changes there, where there is normally at that age a hyperemia. The same impurities in the poorly ventilated air space, entering the pregnant woman's circulation, are carried to the centres of ossification in the fetus and cause the groundwork of the rickets subsequently developing in the child.

The Normal Body Temperature of Children and the Effect of Exercise and Rest.—Dora Fraenkel (*Deutsch. med. Woch.*, 1913, xxxix, 267) offers the results of an investigation on 163 children to determine the normal temperature per rectum and to find a cause for elevation of temperature so often found in normal, healthy children. Diurnal variations in temperature are frequently found in apparently healthy children, and some authors claim a daily elevation to 37.5; C. or 38° C. to be a significant indication of latent tuberculosis. Elevation in temperature in apparently healthy children has been explained by various authors as being due to adenoiditis, local overheating of the rectum from bacterial action, and nervous excitability in sensitive children. Almost all the children in the Borgsdorf institution showed an after-dinner (noon) temperature of from 37.6° C. to 38.5° C., without any physical symptom of illness to explain it. The children under observation numbered 137, aged between five and one-half and thirteen years, and 26, between fourteen and sixteen years. These children were free from adenoids and enlarged tonsils. Only those children were chosen who showed a morning and evening temperature, taken in bed, of 37.2° C., and over a period of three days. During the experiment the temperature of these children was taken by rectum, while still in bed at 7 A.M. It was again taken at 4.30 P.M. after an hour and a half unrestrained play and romping. It was taken a third time at 8 P.M., one hour after they had been put to bed. The thermometer was inserted 4½ centimeters into the rectum and held there until the mercury stopped rising. All of the 163 children so tested showed an elevation of temperature in the afternoon, 4.30 o'clock. In 42 children the temperature rose to 37.6° C., in 85 children to 38° C., and in 36 children to above 38° C. In the first group, 39 children had a morning and evening temperature of 37.2° C.; 83 of the second group, 37.2° C.; and 35 of the third group, 37.2° C. To determine if the afternoon rise in temperature was due to the physical exertion of the play and romping, every child was put to bed immediately after the 4.30 P.M. record was taken. After one-half to one hour's rest in bed every child showed a temperature of 37.2° C., or below, and the longer the rest the lower the temperature was recorded. The tests were made daily for three weeks, and the

children again examined to determine their perfect health. The results of all the measurements were the same. Of the 163 children 113 showed a positive reaction with tuberculin (Pirquet's reaction), but the positive children differed in no respect from the negative ones, in the temperature reaction from bodily exercise. Fraenkel finds the normal temperature per rectum to be 37.2° C. in 96.3 per cent. of the children. The difference between rectum and axilla was never more than 0.5° C. Bodily exercise in all children increases the temperature to 38° C. and above, which drops to normal again after rest. Neuropathic children show a higher rise of temperature following exercise than normal children, when the atmospheric temperature is 16° to 25° C. or over.

Non-gonorrheal Conjunctivitis in the Newborn and Infants.—C. CREDE HORDER (*Deutsch. med. Woch.*, 1913, xxxix, 74) points out that frequently newborn infants and older babies suffer from a conjunctivitis which is not gonorrheal and which under proper treatment leaves no serious consequences. The habit of attributing all inflammations of the conjunctiva in the newborn to gonorrhea tends to invalidate statistics. Diagnosis of such conditions should always rest on microscopic examination, which would show gonorrheal inflammation to be less prevalent than is supposed. The non-gonorrheal conjunctivitis differ from the gonorrheal type in that the cornea is not involved and that the secretions are more serous than purulent and are less in amount. The microörganisms found in the non-gonorrheal type were studied by cultural methods and found to be most frequently a Gram-positive diplococcus, the pneumococcus, and the colon bacillus. Infection with the first-mentioned coccus occurs from the sixth to the sixteenth day of life, is mild in type, and has a serous secretion. Infections with the pneumococcus causes a much more severe inflammation with secretion of pus, edema, fibrinous exudate, and slight hemorrhages. The cornea remains intact and the course is from two to three weeks. Infection with the colon bacillus is milder, the secretions mostly serous, and the course from four to eight days. The treatment consists in frequent cleansing with solutions of boric acid and the instillation of weak solutions of the silver salts.

OBSTETRICS

UNDER THE CHARGE OF

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Intracranial Bleeding in the Newborn following Rupture of the Tentorium.—BENTHIN (*Monatsschr. f. Geburts. u. Gynäk.*, 1912, Bd. xxxvi, Heft 3) draws attention to the occurrence of this accident in newborn children, and believes it may be favored by improper methods of

protecting the perineum, if too great pressure be made against the perineum at the time of labor. In 1239 labors there occurred 8 deaths from rupture of of the tentorium, probably caused by violent or sudden manipulation and unnatural pressure upon the head in efforts to prevent laceration of the perineum.

The Outdoor Treatment of Puerperal Infection.—YOUNG and WILLIAMS (*Boston Med. and Surg. Jour.*, 1912, No. 11) report the results of their investigations in the Boston City Hospital in the outdoor treatment of puerperal septic infection. The patient is kept out of doors in a wheeled bed, which can be moved into the ward when necessary. Sunlight seems to be as important as air, and except in hot weather the patient is placed directly in the sun. Iron and arsenic are valuable aids in restoring hemoglobin, and strychnine is a useful stimulant to the vascular and nervous system. Alcohol increases the appetite, preventing loss of flesh in prolonged cases. Fluids are given copiously by the mouth, and in severe cases salt solution by the bowel. If there is fever, alcohol and cold sponge baths are used. Abdominal distention is treated by hot or cold applications. Young and Williams believe that the outdoor treatment has reduced mortality in severe septic infection nearly 20 per cent. The treatment does good by increasing the amount of hemoglobin, and for this purpose sunlight is as important as fresh air. The use of the curette is contraindicated, as it increases mortality nearly 10 per cent. A single intrauterine douche of sterile salt solution may be used if indicated. The value of this is denied by some. Not much result has followed the use of antistreptococcic serum. The outdoor method is the most effective known at present for puerperal infections, for the reasons stated.

Pituitrin Extract in Inertia Uteri.—HUMPSTONE (*Amer. Jour. Obstet.*, September, 1912) reports his experience with pituitrin extract in the treatment of uterine inertia. He used pituitrin in 64 selected cases without unfavorable results to mother or child. The remedy is expensive, but in some cases is efficient. Two preparations were employed, one the vaporoles of pituitrin extract, made by Burroughs, Wellcome & Co., 1 cm. representing two decigrams of the fresh posterior lobe of the pituitary body; and pituitrin manufactured by Parke, Davis & Co., in ampules containing 1 c.c., representing 1 decigram of the fresh pituitary gland. Apparently the better results were obtained in the first described material. The remedy must be given hypodermically and in the substance of the muscles. The first dose varies from 1 decigram to 1 gram; 4 decigrams, or 4 c.c. of pituitrin solution was the first dose, repeated every twenty minutes, in three doses. No more was given if no result was obtained. The objection has been made that pituitrin raises blood pressure. With patients in labor this effect is not so pronounced as at first supposed. The highest elevation observed was 20 points, the average, 8. The lower the blood pressure in the beginning the greater was the elevation from the use of the drug. The pressure was continued for two hours. If blood pressure is over 150 at first, with a possible lesion of the heart or kidneys, the remedy should not be used; but if such is not the case,

its effect on blood pressure need not be feared. In early pregnancy the drug does not act as an abortifacient. Uterine contraction may result, but the contents will not be expelled. In the induction of labor, after the bag has been introduced, the remedy has some effect. It will not, however, bring on labor. The remedy should not be used before the cervix is shortened and dilated sufficiently to at least admit three fingers. When, however, labor has well started, and especially, after the membranes have ruptured, should delay from simple inertia occur, the remedy has proved efficient. In the second stage good results were seen by giving pituitrin and strychnine, gr. $\frac{1}{20}$, at the same time, hypodermically. [In these cases why was not the good effect obtained as the result of the administration of strychnine, which is a powerful and reliable tonic in labor? E. P. D.] In the third stage of labor with inertia and bleeding, pituitrin causes intermittent contractions of the uterus, and is thus inferior to ergot, which produces tonic contraction. Where immediate contraction is demanded, pituitrin is valuable. It seems also to favor involution. In 7 cases of Cesarean section, ergotole, 30 minims hypodermically, was given at the beginning of the operation. Pituitrin was administered after the sutures were placed in the uterus. In 6 of the 7 cases the results were favorable. In 1 case where pituitrin was given earlier in the operation the uterus contracted so promptly as to interfere with the placing of the sutures, and later on considerable hemorrhage occurred into the abdomen beneath the uterine peritoneum, forming a hematoma which was afterward absorbed.

Primary Uterine Inertia.—Under this heading RYDER (*Amer. Jour. Obstet.*, September, 1912) describes 18 cases of labor characterized by delay due to poor uterine effort. These 18 cases occurred among 175 labors in private patients. Only 3 of these labors started spontaneously, 14 being induced labors by bags, and 1 an attempted induction by the use of bougies. The patients were near term, 12 multigravidæ and 6 primigravidæ. There was no marked disproportion between mother and fetus. Three cases were delivered normally by high forceps, 5 by medium forceps, 5 by version, 4 of these latter because of complications. There was no maternal mortality, but 5 still-births, and 1 infant death, a total infant mortality of 33.3 per cent. One patient lost 15 ounces of blood, and in 6 others the uterine cavity was packed with gauze to avoid hemorrhage. In 4 the placenta was extracted manually, in 2 part of the membranes; 8 had temperatures above 100.6°. Different methods were used in these cases. In the first 5, when inertia occurred, the effort was made to stimulate the uterus and to finish the labor immediately. The results were so discouraging that this method was discarded. If the membranes were unruptured the patients were left alone, and labor was allowed to start spontaneously. The results were good. In the 5 cases where the effort was made to terminate labor virtually by one operation, 4 of the children were lost. In 9 cases inertia was treated by a waiting method. In the 9 cases where the waiting policy was pursued, many of them had induced labor by the introduction of bags which failed to excite pains. The bag was then removed, when labor subsequently developed spontaneously. In 4 cases the premature rupture of the membranes,

or the persistence of weak pains which destroyed sleep without progress, made it necessary to terminate labor. Primary inertia is especially seen in women, aged over twenty-five years, but more often in patients aged over thirty years. It frequently results from mental conditions only, especially when labor is artificially induced. Rupturing the membranes artificially in primary inertia is a most dangerous procedure. Haste must never be practised, as it exposes the mother to suffering and injury, with a fetal mortality of 80 per cent. In patients where in previous pregnancies and abors there has been inertia, tonics and good hygienic treatment should be used during pregnancy. Labor should not be induced if it can be avoided. It is thought that when labor must be brought on, the dilating bag is less apt to cause rupture of the membranes than the bougie. The membranes should rarely be ruptured, and only when the head is well engaged and the conditions all favorable for delivery. With unruptured membranes, the patient should be left alone, and the nervous system quieted by sedatives until rest can be obtained. With ruptured membranes, there is danger to the fetus, and labor should terminate. Primary inertia is most frequent usually in the first stage of labor, and is not of especial importance in the second and third stages. Postpartum hemorrhage is not especially frequent after primary inertia. When labor has terminated ergot should be given freely, and intrauterine packing used if the uterus does not contract well. Cesarean section is often safer for mother and child in primary inertia than a hard forceps operation or breech extraction. Strychnine, quinine, alcohol, and ergot are not satisfactory in these cases. Pituitrin extract may give better results.

Treatment of Cancer of the Cervix Complicating Pregnancy.—LEVANT (*Archiv mens. l'Obstetrique*, September, 1912) believes that abdominal hysterectomy by Wertheim's method is the operation of choice in cancer of the cervix complicating pregnancy and parturition. It has the advantage of permitting the extraction of the fetus by Ceasarean section if the child is viable, while in early pregnancy the uterus may be removed unopened. Vaginal hysterectomy for cancer complicating pregnancy was not satisfactory in his hands, as in 55 cases without Cesarean operation the mortality was 5.4 per cent. These operations were done before, or at the sixth month, and the patient suffered from a return in 31.8 per cent. In 25 vaginal hysterectomies made during the puerperal period, 32 per cent. had a return of the disease in less than one year. The mortality of abdominal hysterectomy by Wertheim's method in cases where cancer complicates pregnancy is considerably less; in the experience of the writer, 16 per cent. during one year; in a subsequent year 18.7 per cent.; then 11.8 per cent.; then 8.6 per cent.

The Treatment of Abortion.—PATEK (*Archiv f. Gynäk.*, 1912, Band xcviii, Heft 1) contributes a paper upon the treatment of abortion in which he analyzes the results obtained by active interference in cleansing the uterus by the curette, with the results obtained by a less vigorous and more expectant method. His conclusions indicate that although fever may be present, the uterus should be emptied

irrespective of all its bacteriological contents, as promptly and thoroughly as possible. Where the patient cannot take ether it may be necessary to secure dilatation by laminary tents, but in the majority of cases etherization and the use of the curette and placental forceps, give the best results.

The Examination of the Blood in Pregnant, Parturient, and Puerperal Patients.—Doi reports from the clinic at Halle (*Archiv f. Gynäk.*, 1912, Band xcviii, Heft 1) the results of his examination of the blood, with especial reference to the toxemia of pregnancy, and the occurrence of eclampsia. He finds that the erythrocytes are somewhat less numerous in pregnant and puerperal patients than in those who are not pregnant. The leukocytes are increased, especially in primiparæ, and increase as labor develops and proceeds. In the first twenty-four hours after labor the leukocytes diminish one-half, and by the fifth day of the puerperal period, are in the normal proportion. This leukocytosis overshadows other conditions in the blood, with the exception of the neutrophile cells. The eosinophile cells and the large cells grow less during pregnancy, disappear during labor, and gradually return during the puerperal period. The index of the neutrophile conditions of the blood is in pregnancy much more developed in parturient patients, and still greater in cases of pregnancy complicated by kidney insufficiency and eclampsia. It returns to the normal in the healthy puerperal period, especially when the albumin disappears from the urine. The blood plates increase in proportion to the leukocytes. In pregnant and parturient women it is not infrequent to see nucleated red blood bodies, microcytes and macrocytes. These disappear during the puerperal period. Changes in the erythrocytes occur more frequently in the kidney of pregnancy than normal, are constant, and are greatly in evidence in cases of eclampsia. The blood changes are much more pronounced in patients having overburdened kidneys during pregnancy than in the normal patient, and these changes are most developed in eclampsia. In infectious disorders the blood changes are in proportion to the virulence of the infection. There is a striking resemblance between the blood changes in pregnancy and those occurring in the blood plates and leukocytes, and reflection of a neutrophile index indicates a predisposition to the formation of thrombi. The blood plates are evidently cells having an important function in blood loss and in the resistance of the organism to toxic material. It is doubtful whether the changes in the leukocytes alone without blood plates, can favor the occurrence of thrombi. From the blood one can gain no knowledge of the actual composition of the toxins present in pregnancy. It is interesting to observe that the least changes in multiparæ with good constitutions, are contrasted with the great changes seen in eclampsia. Primigravidæ having abnormalities have greater blood changes than the normal, and these blood changes are more pronounced in labor than during pregnancy. It is evident that during pregnancy the body is in a condition of very unstable equilibrium, and the changes in the proteid constituents of the body may readily occur and be of very considerable moment.

GYNECOLOGY

UNDER THE CHARGE OF

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Importance of Careful Peritonization After Carcinoma Operations.—BUMM (*Zentralbl. f. Gyn.*, 1913, xxxvii, 1) believes that most careful and thorough covering with peritoneum of all raw areas left after any operative procedure is of the greatest importance, but especially is this true after the radical abdominal operation for carcinoma of the uterus. In his own experience, the effect of a gradual adoption of this principle with corresponding reduction in the amount of drainage used, has been well shown by the coincident steady fall in his mortality. His worst results from this operation were obtained when he routinely drained the pelvic cellular tissue by means of gauze packs brought out through the vagina, the mortality of 138 cases operated on in this manner being nearly 30 per cent. In almost a third of the cases suppuration and sloughing occurred in the tamponed cavities, with resulting necrosis of the peritoneum over them, and ascending peritonitis. Somewhat better results were obtained after he abandoned gauze drainage of the cellular tissue, uniting the loosened bladder and rectum with the edges of the vagina, and closing the raw areas in the broad ligaments on each side with a running suture. Even with this technique, however, he could not get away from the idea of drainage completely, but now placed the drain in the lower angle of the pelvic peritoneum, still bringing it out through the vagina. During this epoch his mortality was 21 per cent., most of it due as before, to ascending peritonitis. All this has been changed, however, since omitting drainage of any sort. Bumm's technique at present is to close all raw surfaces from the free peritoneal cavity by means of a double layer of sutures, the first uniting the edges of the peritoneum, and the second reinforcing these by folding it over a little more, on the same principle that two layers of sutures are placed around any intestinal opening. By following out this technique, Bumm has reduced his mortality in his last 100 cases to the remarkably low figure of 6 per cent., a result which he ascribes solely to the improved method, as the cases were in all respects similar to those of the earlier series. He thinks that the gauze drain only serves to collect wound secretion, which forms an excellent culture medium for the pathogenic organisms which are always present in carcinomatous tissue. When, however, the peritoneum is carefully closed at all points, leaving nothing but a smooth surface, in which no raw areas are to be seen, it is able to take care of considerable quantities of even highly virulent organisms, and to destroy them. One point of importance when following out this technique, however, is to avoid as far as possible spreading infection from the carcinomatous area during the operation, and also never to operate on these patients while they are running a temperature even slightly above normal.

Is Hysteria Ever a Justifiable Diagnosis in Gynecology?—In view of the tendency, which is of late becoming manifest, to ascribe many symptoms apparently referable to the female genital system to psychic disturbances alone, SIPPEL (*Deutsch. med. Woch.*, 1913, xxxix, 263) thinks that a word of warning is in place. Many such cases, especially if no definite pathological condition can be made out by the ordinary examination, are put down as "hysteria," a diagnosis which in the vast majority of cases not only expresses the inability of the attending physician to discover the real trouble, but carries with it two unfortunate sequelæ—failure to relieve the patient of real distress, and the transformation of an originally nervously sound woman into a true neurasthenic because of this failure, and of the knowledge that she is being wrongly judged. Sippel urges that the diagnosis "hysteria" should never be made until most careful and repeated examinations have failed to reveal any demonstrable local lesion, and that even then the possibility of a purely psychic origin of definite pain should be regarded with much skepticism, believing rather that most of these cases merely indicate our inability always to diagnosticate minor anatomical changes. A most useful method of arriving at the true diagnosis in many of these cases has been, in his experience, to have the patient anesthetized merely to the point where sensibility and the ordinary reflexes are just barely lost. If now a reflex can be elicited by pressure on the region complained of by the patient, proof is furnished that an actual physical lesion exists. In cases of a somewhat different category—where a tumor can be felt in the pelvis, but its origin cannot be determined—the employment of the exaggerated Trendelenburg position, in addition to light narcosis, may be of the greatest help. Under these conditions, adnexal tumors will fall sufficiently away from the uterus to be easily differentiated from it, even though with the patient in the ordinary position on the examining table this may have been impossible.

Postoperative Infection of the Urinary Tract.—In order to determine by what routes pathogenic organisms most commonly reach the bladder and upper urinary tract after operation, BAUEREISEN (*Zeitschr. f. gyn. Urologie*, 1913, iv, 1) has made an examination of the organs removed at autopsy from 18 postoperative cases, the majority of these having been Wertheim operations for carcinoma of the cervix. He has found that organisms reach the bladder, in the vast majority of cases, through the urethra, either by spontaneous ascension, or as the result of catheterization. In a few instances, organisms may get to the bladder by way of the blood current, after passing the kidneys; this is especially true of colon bacilli. In the urethras of normal women, not confined to bed, staphylococci are always present, and colon bacilli in 60 per cent.; in bed patients, the colon bacillus also is present in all cases. After a radical cancer operation, the secretion from the wound cavity, rich in pathogenic organisms, flows out through the vagina past the urethral orifice, so that the urethra becomes abnormally rich in bacteria, and it is in this way that they get into the bladder. Only very rarely, apparently, does direct propagation or transportation through the vesical wall take place, this being prevented by the wall of inflammatory tissue that forms in its outer portion, and also by the

adverse lymph current. Infection of the ureter usually occurs in a similar manner—by direct ascension through the lumen, aided perhaps by postoperative over-distention of the bladder. The same factors prevent the transmission of organisms through the ureteral as through the vesical wall. The kidneys are infected most commonly by ascension through the ureter, less frequently through the blood current. In the latter cases the organisms originate from the operative area, not from the intestine, becoming scattered into the blood during the operation, and then partially excreted by the kidney. Of the organisms which may infect the kidney in this manner, the staphylococcus is unquestionably the most dangerous. Once the renal cortex is involved, the organisms may spread to the capsule and cause a perinephric infection. For the fatty capsule, still another mode of infection must be taken into consideration, however, the lymph channels in the connective tissue along the ureters from the true pelvis to the kidneys. Infection by this route causes a perinephritis, which may spread secondarily to the kidney substance.

Influence of Myomas on the Blood Supply of the Uterus.—In continuation of some studies into the blood supply of myomas themselves, published about a year ago, SAMPSON (*Surg., Gyn., and Obst.*, 1913, xvi, 144) now reports the results of his investigations into the effect that the presence of such tumors has upon the circulation of the uterus. The method pursued in both these lines of investigation has been to inject large numbers of myomatous uteri with various substances, in some cases using colored gelatine masses, red for the arterial system, blue for the venous, in others, radio-impenetrable substances, and then to make slices of the organs in various directions, studying these by direct inspection and by means of radiographs. Sampson has found that small and moderate-sized subserous myomas (up to 10 cm. in diameter) do not disturb the uterine circulation, and do not alter menstruation. Larger subserous tumors may produce marked enlargement of the branches of the uterine artery from which they derive their nourishment, and may also give rise to large venous channels in their pedicle and in the peripheral zone of the uterus, but the "radial zone," immediately surrounding the endometrium, which is normally anemic, remains unaffected. There is therefore no excessive escape of blood into the uterine cavity in these cases, and menstruation in them also is unchanged. Occasionally, however, the large venous channels in the pedicle become injured by movements of the tumor, and give rise to hemorrhage into the peritoneal cavity. Intramural myomas do not appear to alter the arterial blood supply of the uterus to an appreciable extent, unless present in very large numbers, in which case the uterine arteries may be somewhat enlarged. The venous plexus of the myometrium may show about the tumors a localized, or even a general dilatation, varying with their size, and when the myomas are very numerous there may be an increase in the thickness of the uterine wall, due to an actual hypertrophy of the myometrium, to a dilatation of the venous plexus, or to a combination of both these factors. Such tumors do not greatly interfere with the circulation of the uterus, and do not usually alter menstruation, although they may indirectly cause menorrhagia or metrorrhagia, the factor of muscular

insufficiency probably playing an important role in these cases. Intramural myomas which encroach on the uterine cavity cause an atrophy and anemia of the mucosa immediately over them; the remaining endometrium is usually hypertrophied, and its venous plexus more dilated than normal. It is from this portion of the endometrium, and not from that encroached upon by the tumors, that the menstrual flow occurs. When excessive hemorrhage takes place in these cases, it is probably due to failure of the uterine muscle to control properly this excessive amount of venous blood, and to a slow regeneration of the endometrium. Occasionally dilated veins in the endometrium over the tumor may become eroded, and give rise to bleeding, but this is not very common. Submucous myomas represent merely a later stage of the intramural variety; the veins over the surface of these are more exposed to injury or degeneration than with intramural tumors, but even here the source of profuse menstruation is usually the portion of the endometrium not encroached upon.

DERMATOLOGY

UNDER THE CHARGE OF

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Cosmetic and Toilet Powders.—KAPP (*Dermat. Woch.*, 1912, No. 16) concludes that the vegetable powders always injure the skin in a mechanical way through the swelling of the granules in the follicles. Rice powder is the least injurious, as it swells the least. Concerning mineral powders the sharp edges of the crystals of some of them may injure the skin. Zinc oxide, precipitated magnesium carbonate, and magnesium silicate being the least objectionable. Bacteriological examinations go to show the possibility of the transmission of various diseases by means of powder puffs and the like.

Noguchi Luetin Reaction in Dermatology.—D. O. ROBINSON (*Jour. Cutan. Dis.*, August, 1912) states that luetin is the extract prepared from pure cultures of the Spirocheta pallida, and is intended for use in the diagnosis of syphilis as von Pirquet's test is for tuberculosis. Noguchi informs us that the extract of the pallida, which he designates "luetin" does not produce any marked inflammation in the skin of non-syphilitics, while it gives a definite lesion formation in most cases of tertiary, latent, and late hereditary syphilis. Robinson's conclusions are in effect that the luetin reaction was found to be specific for syphilis and affords a means of diagnosis in certain cases.

It was absent in primary and secondary untreated cases. It was present in all cases of tertiary, latent, and late hereditary syphilis in the cases reported, and in these forms of the disease was more constant than the Wassermann reaction.

Organism Found in Leprosy.—Duval and Wellman (*Jour. of Cutan. Dis.*, July, 1912), from "a critical study of the organisms cultivated from the lesions of human leprosy, with a consideration of their etiological significance," arrive at the following conclusions: Out of 29 cases of leprosy in Louisiana, Duval and Wellman found an acid-fast bacillus in 22 cases. A chromogenic strain similar in all essentials to that described by Clegg was recovered in 14 cases, which under certain conditions grows as (1) non-acid-fast streptothrix, (2) non-acid-fast diphtheria, and (3) an acid-fast bacillus. The role played by the bacillus of Clegg in the production of leprosy is an unsettled question. The wide variation in morphology and staining reaction would go to show that the Bacillus lepræ is one of pleomorphism.

High-frequency and High-tension Currents in the Treatment of Certain Skin Diseases.—A. Fontana (*Dermat. Woch.*, May 4 and 12, 1912) refers to many cases of diverse disease in which these currents were employed over a period of several years, used in the form of effluve, brush electrode, condensation electrode, and sparking, with the view of obtaining soothing effect (*e. g.*, in pruritus, eczema, etc.), revulsive effect (*e. g.*, in alopecia areata, etc.), decongestive effect (*e. g.*, in acne, wart, lupus, etc.), reparative effect (*e. g.*, in atonic ulcerations, etc.). Perhaps the best results were obtained from the effluve, but these were not uniformly favorable. On the whole, the results were not entirely satisfactory.

Generalized Iodine Acne and Macular Exanthem following the Application of Tincture of Iodine.—Hodara (*Dermat. Woch.*, 1912, No. 10) reports the following unusual iodine eruption: A man, aged sixty-seven years, applied tincture of iodine on three successive days to painful areas following intercostal neuralgia, and covered it with oil-cloth. Some days later an eruption suddenly appeared, consisting of acne-like papules with small pustules upon the tops, surrounded by a red halo. This eruption spread over the whole body, covering the face and head, and in a less degree the trunk and extremities. Upon the limbs and the trunk there was also a macular eruption consisting of round and irregularly-shaped macules. There was no fever or other constitutional disturbance. On account of its resemblance to variola some of Hodara's colleagues were inclined to regard the eruption as either varioloid or varicella. In connection with this case reference may be made to another one recently reported by Goodall (*British Jour. Dermat.*, June, 1912), in which a varioliform eruption followed the internal administration of ferrous iodide.

The Influence of Milk Fat on the Skin.—Montgomery and Culver (*Jour. Cutan. Dis.*, June, 1912) in a short but most interesting paper on the influence of fats of various kinds, especially the fats derived from milk, upon the skin, express the opinion that the ingestion of

large quantities of butter or other fats obtained from milk increases very much the difficulties of successfully treating seborrhea and seborrheic affections. While they do not believe that the quality and quantity of fat taken acts as a poison, they do believe that it lowers the resistance of the skin and increases its susceptibility to attack by bacteria of various kinds, making the patient more liable to acne, seborrhoic eczema, furuncle, carbuncle, and erysipelas.

The Etiology of Lupus Erythematosus.—FRESHWATER (*British Jour. of Dermat.*, February, March, 1912) does not think there is sufficient evidence, clinical, histological, or bacteriological, to prove that lupus erythematosus is always a tuberculous lesion. The hypothesis that it is due to a tuberculous toxin in the blood is far from satisfactory, since there are numerous cases in which there are no signs of tuberculosis. The fact that it sometimes follows a local injury to the tissues, such as frost-bite, sunburn, etc., strongly suggests that it may occasionally be due to purely local causes. Since a large proportion of cases of erythematous lupus suffer from some anomaly of the circulation, Freshwater thinks the skin is, on that account, less able to tolerate the effect of toxins circulating in the blood, and therefore more liable to disease. The primary implication of the blood-vessels, and the symmetrical arrangement of the disease in the majority of cases, favors the theory that the causal agent acts through the blood. He concludes that erythematous lupus is probably brought about by some injury to the skin in an individual with a feeble circulation, to which may be added some toxin circulating in the blood.

Granuloma Pediculatum (So-called Human Botryomycosis).—HEUCK (*Dermat. Zeitschr.*, March, April, May, 1912), from a recent study of the so-called human botryomycosis, concludes that this affection, which is identical with the granuloma telangiectaticum of Kütner, is a well-defined form of disease, for which he proposes the name "granuloma pediculatum," dropping that of botryomycosis. According to its histological structure it may be divided into two groups: (*a*) granuloma pediculatum simplex, which is essentially composed of granulation tissue with an inclination to dilatation of the vessels and proliferation of the endothelium and the perithelial spindle cells; (*b*) granuloma pediculatum angiomatosum, which shows the same structure, but with an inclination to the formation of excessively large blood-spaces and well-marked foci of spindle cells. From its structure, seat, and benign character it may be concluded that it is a simple inflammatory granuloma which arises from trauma and infection. It is distinguished, however, from simple granulation tissue by the marked tendency to dilatation of the vessels, the inflammatory proliferations, and the perivascular collections of spindle cells which may be so considerable as to resemble sarcoma. The etiology of granuloma pediculatum is yet unknown; that the Staphylococcus pyogenes aureus plays a role in its production has not yet been proved. It seems in the highest degree probable that it arises from some external infection. Heuck believes (as most of those who have recently studied the affection) that it is not identical with the botryomycosis of animals.

The Etiology of Impetigo Contagiosa.—K. Dohi and Sh. Dohi (*Archiv f. Dermat. u. Syph.*, 1912, Band cxi, Heft 2), as the result of their study of impetigo contagiosa, conclude that there are two forms which are clinically and etiologically different. The first form is distinguished clinically by the formation of vesicles and blebs with clear, later cloudy, contents which leave thin crusts. In the contents of the lesions as well as in the surrounding skin white staphylococci may always be demonstrated. The second variety is characterized by the formation of wax-yellow thick crusts, and in the lesions of this form which become pustules, streptococci are always present. When yellow staphylococci are present in either form it is as the result of secondary infection. The first form, that due to the white staphylococci, frequently occurs epidemically in small children and only in the warm season of the year, while the second variety occurs sporadically at all seasons, in adults as well as children, but mostly in young people.

PATHOLOGY AND BACTERIOLOGY

UNDER THE CHARGE OF

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The Life-cycle of Spirochetes.—Much interest has lately been aroused in the supposed life-cycle of Spirochæta pallida which has been discovered in a complete series of phases. E. H. Ross (*British Med. Jour.*, December 14, 1912) publishes a short paper indicating his understanding of the process, but we regret to say that priority cannot be given to him until there is a satisfactory answer to the letter of J. E. R. McDonagh, of the London Lock Hospital, published in the *British Medical Journal* of December 21, 1912, for in this letter the latter states that the discovery is his own, and that he has given his colleague, Dr. Ross, material which showed the life-cycle, without any acknowledgement of the same having been made. It may be recalled that de Korte, in the *Practitioner* for June, 1906, described cyst-like bodies containing crystalline threads, in the chancres of syphilitic patients. Study by the jelly method of staining (*in vivo*) with borax methylene blue serves to show the parasites, which appear as copper-colored bodies, either free or ameboid, or enclosed in mononuclear cells. In the copper-colored cytoplasm are granules, and a nucleus which appears as a clear space with a black, dotted centre; should the parasite die, the sphere becomes colorless; 143 cases of preliminary and secondary syphilis have been examined, and the intracellular and extracellular bodies have been found in every case; they have been so found in chancre, in non-suppurative lymph nodes, in the blood from maculæ and condylomas, in ulcerating tonsils,

and in the peripheral blood. Ross considers that these round or pear-shaped bodies, originally free, become included in the cytoplasm of various kinds of cells; here they surround themselves with a wall. Growth proceeds and the chromatin divides. The chromatin within the parasites stains deeply in masses, and these masses vary in number from one to twelve. While still within the cell, in some cases, the chromatin mass, when it has reached full size, gives origin to several minute curled and twisted threads which closely resemble Spirochete pallida. Ross sees a parallel to the intercellular parasites found in guinea-pigs and earth-worms; he has failed so far to find these bodies in non-syphilitic cases. The suggestion is that the spirochetes are really microgametes or male elements, and that some of the round or pear-shaped bodies are possibly macrogametes or female elements. In the same number of the *British Medical Journal* appears a paper by E. JENNINGS, who has used the jelly method and found the same bodies as are here mentioned; while S. R. MOOLGAVKAR, still in the same number, describes similar bodies.

Thyroid Action and Reaction.—FARRANT (*Proc. Royal Soc. Med., Path. Soc.*, London, 1912, vi, 21) points out that there has been a general recognition among pathologists that the histological appearance of the thyroid is apt to be modified in sundry cases of infection. Hitherto, to our knowledge, no one has carefully studied this matter, so that Farrant's observations here given appear so novel as to demand confirmation. Nevertheless the fact that they emanate from Prof. Cushing's laboratory is in itself strong evidence in favor of their immediate acceptance. Farrant points out that the thyroid secretion reaches the circulation by means of the veins, that absorption occurs by the lymphatics is now known to be erroneous. The inferior thyroid veins are the largest, and more than two-thirds of the thyroid secretion reaches the left side by means of the thyroid veins. The left innominate vein receives the thoracic duct, the right, the right lymphatic trunk. Thus there is a correspondence between the opening of the thyroid veins and of the lymphatic trunks, and it may well be asked whether the thyroid has any influence upon the destruction of toxins reaching the venous system through the main lymphatics. Farrant illustrates by numerous photographs that in cases of infantile diarrhea, diphtheria, measles with bronchopneumonia, and whooping cough with bronchopneumonia, according to the duration and intensity of the disease, so does the thyroid present evidence of a succession of changes which can only be regarded as indicating increased production and discharge of secretion. He notes the following succession of changes: (1) The colloid becomes finely granular; (2) it becomes vacuolated and partially absorbed; (3) the cells lining the vesicles become more numerous, elongated, approaching the columnar type and arranged in masses; then the colloid becomes entirely absorbed, becoming crenated and infolded; (4) the infolding and cell increase tend to transform the vesicles into solid masses of cells. He next proves from experiment that this thyroid reaction is caused by the toxins, finding the same succession of changes to occur in the thyroids of guinea-pigs which have been injected with diphtheria toxin, and he is able to show that when the guinea-pigs injected with diphtheria toxin

are simultaneously given thyroid powders, there is a marked delay in the fatal event, so much so that guinea-pigs, previously fed on thyroid, in several cases survived when given one and a half times the minimal lethal dose. These findings led to a further series of observations in which it was discovered that blood serum of the thyroid fed animals gains definite antitoxic properties. Of the 5 guinea-pigs which had been so fed, 4 survived one and one-half times the minimal lethal dose of diphtheria, whereas all the controls died in from two to six days. The one exception died with an abscess developing in the neck. It is further noted that rabbits fed with diphtheria toxin developed the same symptoms as those produced by thyroid feeding, namely, loss of weight, tachycardia, fur changes, etc., while diphtheria antitoxin fed to thyroidectomized animals in similar quantities has no ill results; on the contrary, there is a distinct gain in weight. Lastly, it is found that in horses employed in the production of diphtheria antitoxin, the serum contains much more iodine than does that of the normal animal. From this it is concluded that certain toxins stimulate the thyroid into a condition of hyperplasia; during this change it seems probable that iodine-containing substances are poured out into the circulation. This indicates some close relationship between thyroid function and the development of certain antitoxins, and it is suggested that the hyperplasia observed in the condition of toxemia above noted is intimately associated with the attempt to form antitoxins. The article is illustrated with 30 good microphotographs of sections of thyroid in various conditions—cases of the disease as above noted, from horses treated with diphtheria toxins, and from guinea-pigs similarly treated.

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